

# THE LICHEN FLORA OF SOUTHERN CALIFORNIA.

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BY HERMANN EDWARD HASSE.

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## INTRODUCTION.

A study of the lichen growth of Southern California, pursued mostly in the county of Los Angeles for more than a score of years, has brought to light a number of species previously undescribed, as also the presence of some known species new to North America.

For the determination of these the writer was indebted to Dr. Ernst Stizenberger during his life, and afterward to the late Dr. William Nylander, who named a large number. Subsequently Dr. A. Zahlbruckner has kindly continued this work and has published some of the species determined by himself with a few of Doctor Nylander's briefly described new species.<sup>1</sup> A few species named by Nylander appeared in a posthumous publication under the title "Lichenes Ceylonenses."<sup>2</sup> Doctor Stizenberger, it is believed, did not publish any of the Southern California Lichens named by himself.

At various times and in different pamphlets and journals the writer has issued lists and short descriptions of his collections, and the consolidation of these scattered reports is, in part, the object of this paper. In the preparation the author has made free use of and has been guided by the work of Dr. A. Zahlbruckner, "Ascolichenes," in Engler and Prantl, "Die Natürlichen Pflanzenfamilien,"<sup>3</sup> the most important and advanced work of recent times on the subject. The suggestions of Dr. V. Darbishire as to designations of the apothecial structures, incorporated by Prof. M. Fünfstück in his "Lichenes" forming the "Allgemeiner Theil" of the same work,<sup>4</sup> have been adopted. The author also desires to express his grateful acknowledgment for aid given by several correspondents. Mr. S. B. Parish, of San Bernardino, kindly submitted a large collection determined by Doctor Stizenberger. Mr. C. R. Orcutt, of San Diego, generously gave a number of interesting forms determined by Prof. Edward Tuckerman, and Dr. A. C. Herre has contributed specimens of many species

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<sup>1</sup> Bull. Torrey Club 27: 642-647. 1900; Beih. Bot. Centralbl. 13: 149. 1902.

<sup>2</sup> Act. Soc. Sci. Fenn. 26: 1-33. 1898.

<sup>3</sup> 1<sup>1</sup>\*: 49-243. 1907.

<sup>4</sup> Engl. & Prantl, Nat. Pflanzenfam. 1<sup>1</sup>\*: 41.



demonstrating their range northward. Mrs. Blanche Trask, of Santa Catalina Island, sent valuable insular lichens. Miss Alice Eastwood, as Curator of the Herbarium of the California Academy of Sciences at San Francisco, lent a large heretofore undetermined collection of Pacific coast lichens, made by Dr. E. L. Greene, T. S. Brandege, Dr. Albert Kellogg, and others, representing plants from the extreme of Lower California to Alaska. This important collection was lost shortly after its return to San Francisco in the catastrophe of April 18, 1906. Mr. F. M. Reed, of Redlands, has also contributed valuable forms. To Dr. J. N. Rose, Associate Curator of the United States National Herbarium, the writer is especially desirous of expressing his great appreciation of the valued advice and help afforded in the preparation of this paper.

Briefly stated, Southern California, as here understood, is the portion south of the  $36^{\circ}$  parallel, containing the counties of Kern, Santa Barbara, Ventura, Los Angeles, Orange, Riverside, Imperial, and San Diego, in area amounting approximately to one-third that of the State. It may be divided into three main topographical sections, a coastal, a mountain, and a desert. The first ascends gradually from the coast line to the foothills of the second or mountain district, reaching an average altitude of 100 meters; it is mostly open country, sparsely wooded, fairly well watered, and mainly devoted to agriculture or grazing. Earth, rock, and corticular lichens are about equally represented in it. The second (mountain) section, facing southwestward, rises abruptly from the former to an average height of 1,500 meters, with several elevations up to 3,000 and 3,700 meters, and having a width of 150 kilometers, more or less; its flanks are clothed by an often impenetrable chaparral growth, while toward the summits a more open arboreal growth prevails. This district offers a rich vegetation of fruticulose and crustaceous as well as foliose lichens on earth, rock, and bark. From this toward the third or desert section the descent is more gradual and passes into the desert plateau of 1,200 meters elevation, gently sloping east and northeasterly, southward descending to, and in some localities even below, the sea level. This desert section is arid, practically waterless the greater part of the year, sustaining a brushy, with here and there a stunted arboreal vegetation. The lichens are chiefly terrestrial or saxicolous, bark forms being quite rarely seen. That the scanty precipitation and low atmospheric humidity are not entirely accountable for this paucity of lichen growth is evidenced by the fact that, though in localities sheltered from wind and sunlight, lichens flourish in a measure, they do not appear in as great variety of species as elsewhere. The prevailing, often severe, dust and sand storms form an active factor in prohibiting the life of lichens or their symbionts. In the coastal section the average annual precipitation is 30 to 45 cm., less



in the southern part, and considerably in excess of this in the mountain section, where at the highest points snow frequently lingers into June and July. In the second district the rainfall is very much less. Accurate meteorological statistics, however, for this and the mountain region are not available.

In the following systematic treatment species cited from definite localities without mention of the collector's name are either of common occurrence locally or have been collected by the writer. In the case of certain common cosmopolitan species it has seemed unnecessary to mention any specific localities.

### SYSTEMATIC TREATMENT.

#### LICHENES, subclass ASCOLICHENES.

##### KEY TO ORDERS.

- Hymenium soft, globose or semiglobose, covered  
or inclosed by the perithecium, perforated by  
an apical pore or fissure ..... **PYRENOCARPEAE** (p. 3).  
Hymenium exposed, disk-shaped ..... **GYMNOCARPEAE** (p. 14).

##### Order PYRENOCARPEAE.

Thallus mainly crustaceous or squamose (the few foliose or fruticose forms not found within our limits); algæ either bright green Chlorophycaceae (*Pleurococcus*, *Palmella*, *Chroolepus* algæ), or blue green Cyanophycaceae (*Nostoc* or *Sirosiphon* algæ); perithecium generally dark to black, brittle, globular (entire) or semiglobular (dimidiate), and wholly or partly immersed in the thallus; apical pore minute, punctiform or variously fissured; inclosed hymenial structures soft, gelatinous, with or without hymenial gonidia; paraphyses simple or branching, frequently gelatinous and indistinct and apparently absent; spermatia endobasidial or exobasidial.

##### KEY TO FAMILIES.

- Cavity of perithecium not divided by septa.  
Thallus with *Pleurococcus* or *Palmella*  
gonidia.  
Crustaceous ..... **VERRUCARIACEAE** (p. 3).  
Squamulose ..... **DERMATOCARPACEAE** (p. 8).  
Thallus with *Chroolepus* gonidia, crustaceous; perithecium without septa ..... **PYRENULACEAE** (p. 11).  
Thallus with *Nostoc* gonidia ..... **PYRENIDIACEAE** (p. 12).  
Cavity of perithecium completely or incompletely partitioned by septa ..... **MYCOPORACEAE** (p. 13).

##### VERRUCARIACEAE.

Thallus crustaceous, ecorticate; symbionts *Pleurococcus* or *Palmella* gonidia; perithecium simple, erect, perforated vertically by the apical aperture; thecal contents soft; paraphyses and asci membranes often gelatinous, indistinct, the former at times apparently absent. Our species do not contain hymenial gonidia.



## KEY TO GENERA.

- Paraphyses soon gelatinous, indistinct or absent.  
 Spores simple..... VERRUCARIA (p. 4).  
 Spores not simple.  
   Spores 2 to 4-locular..... THELIDIUM (p. 6).  
   Spores muriform-multilocular..... POLYBLASTIA (p. 6).  
 Paraphyses permanent, distinct.  
 Spores simple..... THROMBIUM (p. 6).  
 Spores muriform-multilocular..... MICROGLAENA (p. 7).

## VERRUCARIA Scop.

Thallus crustaceous, presenting the different phases from pulverulent to smooth, and either areolate or disappearing.

## KEY TO SPECIES.

- Apothecia wholly immersed in thallus, only the ostiole free.  
 Perithecia large.  
   Thallus brownish to dull black..... 7. *V. nigrescens*.  
   Thallus green brown, the color distinct when moist..... 8. *V. viridula*.  
 Perithecia small.  
   Thallus green black, thin..... 9. *V. dacryodes*.  
   Thallus black, finely rimose, thin..... 10. *V. maura*.  
 Apothecia not wholly immersed, sessile or only half immersed.  
 Perithecia sunken in matrix..... 1. *V. calciseda*.  
 Perithecia not sunken in matrix.  
   Thallus obsolete..... 5. *V. margacea terrestris*.  
   Thallus present.  
     Thallus white or whitish.  
       Whitish to light brown..... 2. *V. rupestris*.  
       Creamy white, mealy..... 3. *V. integrella*.  
     Thallus dull brownish.  
       Perithecium concolorous..... 4. *V. margacea papillosa*.  
       Perithecium black..... 6. *V. aethiobola*.

1. *Verrucaria calciseda* Lam. & DC.

Thallus pulverulent, whitish, giving its substratum a dull white coating, effuse, at times wanting; perithecia brownish black, depressed hemispherical, impressed in shallow cavities in the rock; ostiole irregularly poriform; perithecium dimidiate, dark brownish black, the amphithecium also dark; paraphyses gelatinous, apparently shorter than the asci, these ventricose, about 100  $\mu$  long, 28  $\mu$  thick; spores 8, colorless, simple, ovoid-ellipsoid, while inclosed in the ascus 11 to 13  $\mu$  long, 8 to 11  $\mu$  thick, when expelled measuring 20 to 24  $\mu$  by 8 to 11  $\mu$ ; hymenial gelatine staining light blue then vinous red with iodine.

On calcareous rocks at lower and middle elevations in the mountains of Ventura and Los Angeles counties. Of wide distribution in North America, also in Europe.

2. *Verrucaria rupestris* Schrad.

Thallus light grayish to dusky leathery brown, granular-furfuraceous; perithecia medium small, 0.2 to 0.25 mm. in diameter, numerous, semi-immersed in the thallus, the projecting perithecium dull black; spores oblong-ellipsoid, 20 to 27  $\mu$  long, 7 to 12  $\mu$  thick; paraphyses gelatinous, obscure; hymenial gelatine a pale claret color with iodine, the spores yellowish.



On granite rocks, common throughout our district. A North American lichen occurring also in northern Africa and Europe.

**3. *Verrucaria integrella* Nyl.**

Thallus pale grayish cream color, furfuraceous, indistinctly rimose-areolate; perithecia black, innate, sessile and projecting above the thallus, depressed-globular, dimidiate, the apical aperture very minute, often invisible; asci lanceolate, tapering upward; paraphyses absent; spores 8, ovoid, 17 to 20  $\mu$  long, 11 to 15  $\mu$  thick, the contents with one or several oil globules more distinctly defined than the episporium; no reaction with iodine.

On argillaceous shale in the Santa Monica Range.

**4. *Verrucaria margacea papillosa* (Ach.) Nyl.**

Thallus sordid light green brown, effuse, subrimulose and rugulose; perithecia dull black, dimidiate, semiglobular, the lower part covered by the thallus; amphithecium soft, light brown; paraphyses gelatinous; asci ventricose, 80 to 92  $\mu$  long, 28 to 30  $\mu$  thick, the membrane gelatinous and indistinct; spores ovoid-ellipsoid, 16 to 20  $\mu$  long, 7 to 10  $\mu$  thick; hymenial gelatine stained yellow with iodine.

On argillaceous rock at Ballona Bluffs near Santa Monica.

**5. *Verrucaria margacea terrestris* Nyl. subsp. nov. in litt.**

Thallus indistinct or absent; perithecia semiglobular, black; spores as in the preceding variety.

On clay, foothills of the Santa Monica Mountains, near the Soldiers' Home.

**6. *Verrucaria aethiobola* (Wahl.) Ach.**

Thallus pale tan color or pale olive greenish, thin, subdeterminate or in small blotches, partly covering the base of the perithecium, this black, small, semiglobular, somewhat shining and with a minute aperture, dimidiate; asci broadly saccate and ventricose, gelatinous and indistinct like the paraphyses; hymenial gelatine pale vinous red with iodine; spores 8, oblong-ellipsoid, their granular contents clearing after KHO, 15 to 20  $\mu$  long, 6 to 8  $\mu$  thick.

Not rare in the Santa Monica Range on slaty rocks. Reported from Europe and eastern Asia.

**7. *Verrucaria nigrescens* Pers.**

Thallus brown black to dull black, loosely rimose-areolate and crumbling, often leaving the large perithecia exposed, these dimidiate, black, semiglobular, mostly covered by thallus except the apices; spores oblong-ellipsoid, 17 to 28  $\mu$  long, 8 to 12  $\mu$  thick.

Common on various rocks throughout North America, northern Africa, and Europe.

**8. *Verrucaria viridula* Ach.**

Thallus greenish brown, thick, moistened, dark olive green, areolate-diffract; perithecia large, black, dimidiate, conical, immersed in thallus, the tip alone being visible; spores 8, large, ovoid-ellipsoid, granular, 28 to 32  $\mu$  long, 12 to 15  $\mu$  thick.

Frequent on calcareous and other rocks in our district. Occurs in the middle western United States, in Europe, Oriental Asia, and North Africa.

**9. *Verrucaria dacryodes* Nyl.; Hasse, Bull. South. Calif. Acad. 2: 73. 1903.**

Thallus effuse, thin, dull greenish black to dark olive green, minutely rimose; perithecia small, semiglobular, dimidiate, covered by the thallus, the amphithecium dark gray; asci lanceolate, 60 to 68  $\mu$  long, 24 to 28  $\mu$  thick, very gelatinous; spores 8, obovate-oblong, one end attenuate, 14 to 17  $\mu$  long, 11  $\mu$  thick; paraphyses indiscernible; hymenial gelatine with iodine pale vinous red, the asci being better defined after staining, the membrane 4 to 6  $\mu$  thick, remaining hyaline and the contents of the asci staining yellowish orange.



On argillaceous schist, foothills of the Santa Monica Mountains near the Soldiers' Home.

Type deposited with Dr. W. Nylander in 1897; duplicates in the U. S. National Herbarium and in herb. Hasse ("E stirpe *V. polysticta*" Nyl. in litt.).

**10. *Verrucaria maura* Wahlenb.**

Thallus black, minutely rimose and papillate; perithecium of medium size, dimidiate, internally dark; paraphyses none; spores 8, oblong, 12 to 15  $\mu$  long, 7 to 8  $\mu$  thick; hymenial gelatine vinous red with iodine.

On calcareous beach rocks near Newport and San Pedro, also on Santa Catalina Island. Reported from South America, Europe, northern Asia, and Africa.

**THELIDIUM** Mass.

Thallus crustaceous, thin, uniform, diffuse; hypothallus obsolete; spores 2 to 4-locular.

**1. *Thelidium microbolum* (Tuck.).**

*Verrucaria microbolum* Tuck. Gen. Lich. 2: 269. 1872.

Thallus thin, whitish to pale ash color, minutely areolate; perithecia sessile, small, black, depressed-globular with a minute aperture; spores colorless, broadly ellipsoid, 4-locular, 28  $\mu$  long, 16  $\mu$  thick; paraphyses absent.

On calcareous incrustations, Mill Creek Canyon, at Skinners, San Bernardino Mountains at 1,300 meters elevation.

**POLYBLASTIA** Mass.

Spores muriform-multilocular; otherwise as in *Thelidium*.

**1. *Polyblastia intercedens* (Nyl.) Lönnr.**

Crustaceous, light greenish gray, thin, delicately rimose; perithecia medium large, dull black, dimidiate; aperture depressed; paraphyses absent; spores 8, broadly ellipsoid, 28 to 40  $\mu$  long, 16 to 18  $\mu$  thick; hymenial gelatine with iodine wine red.

Frequent in the Santa Monica Mountains on slaty schist.

**1a. *Polyblastia intercedens aethioboloides* (Nyl.).**

*Verrucaria intercedens aethioboloides* Nyl. Not. Sällsk. Faun. Fl. Fenn. Förh. 5: 276. 1861.

Thallus sordid pale grayish brown, thin, subdeterminate; perithecia minute, dull black; spores ellipsoid, muriform, 18 to 20  $\mu$  long, 8 to 10  $\mu$  thick.

Of the same habitat as the species but less frequent; differing from the latter in its smaller spores. Externally it is similar to *V. aethiobola*, but different in its muriform spores.

**THROMBIUM** Wallr.

Thallus crustaceous, uniform, scurfy-membranous, mucogelatinous when moist; perithecium globose, black, entire, small, immersed, only the minute black apex visible; paraphyses slender, persistent, without hymenial gonidia; asci clavate or cylindric; spores 4 to 8, colorless (with us).

**1. *Thrombium epigaeum* (Pers.) Schaer.**

Thallus thin, effuse, uniform, scurfy; perithecia barely visible by the punctiform black apex, entire; spores 8, colorless, obovate or oblong-ellipsoid, 19 to 23  $\mu$  long, 7 to 9  $\mu$  thick; hymenial gelatine with iodine yellow.

On earth. Foothills of the Santa Monica Range near the Soldiers' Home. Reported as common in North America and Europe.



**MICROGLAENA** Lönnr.

Thallus crustaceous, uniform; perithecia immersed in the thalline verrucæ, globose, entire, soft, light in color, dark only at the apex; paraphyses slender, branching, asci oblong-cylindric, 2 to 8-spored; spores ellipsoid, muriform-multilocular, colorless to brownish.

## KEY TO SPECIES.

- Thallus sordid whitish, squamulose..... 3. *M. subcorallina*.  
 Thallus dull greenish, minutely verruculose.  
     Spores brown..... 1. *M. hassei*.  
     Spores not brown..... 2. *M. sychnogonoides*.

**1. Microglaena hassei** Zahlbr. Beih. Bot. Centralbl. 13: 152. 1902.

Thallus epiphloeodal, thin, dull grayish green to slightly olive green, minutely verrucose, effuse, with *Palmella* gonidia; perithecia simple, solitary, sessile, minute; 0.2 to 0.3 mm. in diameter, the greater part covered by thallus, only the black, punctiform apex being free, dimidiate, olive brown, the ostiole punctiform; paraphyses slender, branching filiform, intertwining, eseptate, persistent; asci numerous, clavate, straight or slightly curved, the membrane thickened at the rounded apex, 90 to 110  $\mu$  long, 20 to 30  $\mu$  thick; spores 8, from colorless soon brownish, ellipsoid to ovoid-ellipsoid, muriform, 20 to 30  $\mu$  long, 9 to 13  $\mu$  thick.

On various barks, principally on *Juglans californica*. Type locality in Sepulveda Canyon of the Santa Monica Mountains, near the Soldiers' Home.

Type deposited with Dr. A. Zahlbruckner in Vienna, Austria; duplicates in herbarium of the New York Botanical Garden, U. S. National Herbarium, and herb. Hasse.

**2. Microglaena sychnogonoides** Zahlbr. Beih. Bot. Centralbl. 13: 151. 1902.

Thallus epiphloeodal, thin, effuse, subverruculose, grayish greenish, KHO —,  $\text{Ca}(\text{Cl O})_2$ —, with *Palmella* gonidia; perithecia minute, 0.3 to 0.5 mm. in diameter, dispersed, depressed, semiglobose, the lower part surrounded by thallus, brownish gray or brown, minutely umbilicate, simple, yellowish red with iodine; paraphyses slender, filiform, about 1  $\mu$  thick, loosely branching and interwoven; asci subcylindric, straight, 90 to 110  $\mu$  long, 17 to 20  $\mu$  thick, the membrane thickened, 4-spored; spores colorless, muriform, 20 to 34  $\mu$  long, 9 to 11  $\mu$  thick.

On the smooth bark of limbs of *Quercus agrifolia*. Type locality, Santa Monica Range near the Soldiers' Home.

Type deposited with Dr. A. Zahlbruckner; duplicates with Dr. A. C. Herre and in herb. Hasse.

**3. Microglaena subcorallina** sp. nov.

*Verrucaria subcorallina* Nyl. in litt., name only.

Thallus epiphloeodal, moderately thick, minutely squamulose or warty, sordid whitish, or sordid grayish dun in color; apothecia imbedded in thalline warts, solitary or rarely two upon a squamule, prominent, semiglobular or subconical, slightly darker than the thallus and, when moist, darkening toward the apex around the impressed vertical aperture; perithecium soft, globose, entire, pale reddish on section; paraphyses capillary, densely intertwining, longer than the asci, apparently branching; asci numerous, mostly lightly curved, cylindric, a little thicker above the base, the membrane thick (about 4  $\mu$ ); spores 8, colorless, ellipsoid in outline, muriform-multilocular, with 5 to 8 septa in the transverse (short) axis, each loculus with 1 to 3 septa in the long spore axis; spores generally disposed longitudinally in single file, 36 to 44  $\mu$  long, 14 to 20  $\mu$  thick; with iodine, spores and ascus contents staining a rich yellow, the ascus membrane and paraphyses not staining.

On smooth bark of young oaks on the western slope of the San Gabriel Range at about 800 meters altitude, along the "New Trail" to Mount Wilson (the type locality).

Type deposited with Dr. W. Nylander in 1897; duplicate in herb. Hasse.



**DERMATOCARPACEAE.**

Thallus foliaceous or squamulose, both surfaces or only the upper with a pseudo-membranaceous cortex, attached centrally by a basal disk or basal rhizinæ, or by the medullary hyphæ to the substratum; with *Palmella* gonidia; perithecium simple, with a punctiform, vertical aperture (ostiolum); spermatia endobasidial.

## KEY TO GENERA.

- Thecium without hymenial gonidia, spores simple..... *DERMATOCARPON* (p. 8).  
 Thecium with hymenial gonidia, spores muriform ..... *ENDOCARPON* (p. 9).

**DERMATOCARPON** Eschw.

Thallus foliaceous or squamulose; perithecium tubular or ovoid, dark or pallid, sunken in the thallus or slightly protruding; paraphyses gelatinous and ill defined; spores colorless, simple; sterigma minute, spermatia oblong, straight.

## KEY TO SPECIES.

Thallus foliaceous.

Monophyllous, large ..... 4. *D. miniatum*.

Polyphyllous, the folia small..... 4a. *D. miniatum complicatum*.

Thallus not foliaceous.

Thallus squamose.

Squamæ lobed to deeply incised, brown..... 1. *D. rufescens*.

Squamæ round to flexuose, brown..... 2. *D. hepaticum*.

Thallus more or less bullate.

Bullate in the center, the peripheral squamæ  
expanding..... 5. *D. intestiniforme*.

Subverruculose-bullate, dark brown..... 3. *D. acarosporoides*.

- 1. *Dermatocarpon rufescens* (Ach.) Zahlbr. in Engl. & Prantl. Nat. Pflanzenfam.**  
 1<sup>1</sup>\*: 60. 1907.

*Endocarpon rufescens* Ach. Lich. Univ. 304. 1810.

Thallus of reddish brown squamæ, lobed, often deeply incised, the margin generally everted and dark granulose; above a thin, brown, pseudoparenchymatous cortex, beneath this thick, closely jointed, vertical hyphæ descending into and through the gonidial layer, merging into the cellular medullary layer; lower surface ecorticate; apothecia, when present, one or more in a squamule, generally from 3 to 6 (indicated by a darkened spot), with minute apertures; asci lanceolate and clavate; spores ellipsoid, 13 to 16  $\mu$  long, 5 to 8  $\mu$  thick, often containing 1 to 3 oil globules; paraphyses not present; hymenial gelatine stained bronze copper color with iodine, KHO giving no reaction; plant often dioecious, many squamules being without apothecia, but spermogones frequent, seen on section as small, light flesh-colored globules under the cortex; spermatia minute, oblong, 4  $\mu$  long and about 1  $\mu$  thick.

Common on earth in open places throughout our district. Near San Bernardino, *Parish*; Santa Cruz Peninsula, *Herre*, and frequent in the Santa Monica Range. New England States; Europe; northern Africa.

- 2. *Dermatocarpon hepaticum* (Ach.) T. Fries.**

Squamules flat, not turned up at the edges, round or roundish to flexuose; asci oblong, 72 to 92  $\mu$  long, 15 to 18  $\mu$  thick, upper part of membrane thickened, covering the cavity calyptra-like; ascus membrane not stained by iodine, but its contents and spores staining a reddish orange to dark copper color and the hymenial gelatine vinous red; spores 8, oval-ellipsoid, 11 to 14  $\mu$  long, 7 to 10  $\mu$  thick.

Same habitat as the preceding and about as frequent. North America and Europe.



**3. *Dermatocarpon acarosporoides* Zahlbr. Beih. Bot. Centralbl. 13: 153. 1902.**

Thallus of bullate, subverruculose squamules, fissured or lobulate, thick, reddish brown, discrete or forming a continuous crust, KHO—, Ca(ClO)<sub>2</sub>—; apothecia single or rarely two in a squamule, immersed, the apex blackening, punctiform, depressed-umbilicate; perithecium globose, pale; paraphyses indistinct; hymenium with iodine vinous red; asci ventricose, cuneate at the base, 80  $\mu$  long by 20  $\mu$  thick; spores in 8's, simple, hyaline, globose or subglobose, 10 to 12  $\mu$  in diameter.

On granite. Type locality, Palm Springs, at the base of the San Jacinto Mountains, at 150 meters altitude.

Type deposited with Dr. A. Zahlbruckner; duplicate in herb. Hasse.

**4. *Dermatocarpon miniatum* (L.) Mann.**

Thallus foliaceous, monophyllous or submonophyllous, beneath centrally attached; fronds 2 to 3.5 cm. wide, roundish, lobed, the margin entire or crenate, pale mouse-colored above, smoothish, leathery brown to dark brown beneath, brittle when dry; apothecia immersed, minutely umbilicate; asci oblong, 80  $\mu$  long, 12  $\mu$  thick, the membrane thickened, especially at the top, leaving the cavity attenuate above; membrane not stained by iodine, but its contents yellow; spores in 8's, oblong-ellipsoid, 14 to 20  $\mu$  long, 4 to 7  $\mu$  thick; hymenial gelatine blue with iodine.

On rocks; not very common but widely distributed in our district. Yosemite Valley; Tehachapi Mountains; San Gabriel Mountains; Palm Springs. North America, northern Africa, and Europe.

**4a. *Dermatocarpon miniatum complicatum* (Swartz) T. Fries.**

Thallus foliaceous but the fronds smaller, polyphyllous and imbricated, ascending, somewhat cespitose; asci subcylindric, the upper part of the membrane thickened as in the last species, very gelatinous; hymenial gelatine with iodine violet blue, the asci cavities yellow, the membrane not stained; spores in 8's, ellipsoid-ovoid, 12 to 16  $\mu$  long, 6 to 8  $\mu$  thick; spermatia short, straight, apparently slightly thickened at the ends, 5 to 6  $\mu$  long, about 1  $\mu$  thick.

On rocks; of the same distribution as the species. San Bernardino Mountains, Parish.

**5. *Dermatocarpon intestiniforme* (Koerb.).**

*Endocarpon intestiniforme* Koerb. Par. Lich. 42. 1860.

Thallus polyphyllous, caespitose, creamy gray in color or sometimes with a faint bluish dash, the borders of the squamæ directed downward, forming bullose cavities of the coarsely areolate central part, the areoles roundish, subangular or frequently angular-wavy, each squamule or bulla containing mostly several apothecia; peripheral squamæ foliaceous, expanding and imbricate; apothecia at first immersed, later becoming prominent, the extruding perithecium dull black with a minute ostiole, the immersed part soft, globular to flattened-globular, of a pale flesh color; thecium colorless; paraphyses gelatinous, indistinct; asci cylindric or bottle-shaped; spores 8, bluntly ellipsoid, colorless, faintly granular, 12 to 18  $\mu$  long, 6 to 9  $\mu$  thick; hymenial gelatine staining blue with iodine, soon changing to orange brown; KHO giving no reaction.

On rocks and earth in crevices of rocks. North Fork of Matilija Canyon, Ventura County; Eden Hot Springs and Palm Springs, Riverside County, to the Grand Canyon in Arizona.

**ENDOCARPON Hedw.**

Thallus foliaceous-squamose, both surfaces or only the upper with a pseudoparenchymatous cortex; perithecium immersed or protruding with the apex simple, erect; thecium with oblong or rounded hymenial gonidia; proper exciple dark; paraphyses gelatinous; asci saccate or ventricose, 1 to 6-spored; spores oblong or ellipsoid, muriform-multilocular, at first colorless, soon light yellowish brown to brown; spermatia cylindric, straight.



## KEY TO SPECIES.

Growing on earth; squamulose.

Whitish to light gray.....3. *E. lepidallum*.

Some shade of brown.

Pale brown; squamules roundish to oblong.....1. *E. pusillum*.

Reddish brown; squamules roundish.....2. *E. subnitescens*.

Growing on rock; thallus minutely squamulose.

Black, small, round, discrete or in confluent patches.....4. *E. wilmsoides*.

Olivaceous-cinerascent, effuse.....5. *E. monicae*.

**1. *Endocarpon pusillum* Hedw.**

Thallus of pale brown or dusky buckskin-colored squamules, roundish to irregularly oblong, entire or flexuous, closely adhering to the substrate, 1 mm. in diameter, or 2.8 mm. long by 1.5 mm. to 2 mm. wide; apothecia marked by a darker colored slight projection, mostly several in a squamule, the aperture minute; on section the perithecium and contents seen dark, globular; asci cylindric-clavate, the membrane thick, gelatinous, indistinct; paraphyses none; spores in 2's, from colorless to light brown and brown, muriform-multilocular, 11 or 12 loculi in the long spore axis and 3 or 4 in the short transverse axis; spores varying in form from ellipsoid to oblong, 32 to 44  $\mu$  long, 13 to 20  $\mu$  thick.

On earth in open places near the Soldiers' Home, Santa Monica Mountains; also near San Bernardino, *Parish*. Eastern and southern United States and Europe.

**2. *Endocarpon subnitescens* Nyl.**

Thallus squamulose, the squamules 1 to 3 mm. wide, reddish brown, thin, lobulate, adherent to the substrate; one to several apothecia immersed in a squamule, their location marked by a brown convexity, the ostiole not discernible; asci 140  $\mu$  long, 60  $\mu$  thick, the membrane gelatinous; spores in 2's, colorless to pale yellowish, muriform, 46 to 80  $\mu$  long, 18 to 28  $\mu$  thick; hymenial gelatine with iodine pale claret.

On earth in the Santa Monica Mountains.

**3. *Endocarpon lepidallum* Nyl. sp. nov. in litt.**

Thallus of small squamules (0.25 mm. to 2 mm. wide), from whitish to pale smoky gray, at first round, later flexuous and lobed, the margin finely granular and blackish, when dry the squamules slightly concave with the margin turned upward; squamules containing from 1 to about 12 apothecia, these immersed, only a minute gray protuberance with a barely discernible ostiole marking them; perithecium dark, dimidiate, black under the hand lens, brown black under a higher power, 52 to 56  $\mu$  thick, the thecial cavity 140 to 160  $\mu$  in diameter; asci 60  $\mu$  long, 20  $\mu$  thick, the apical perforation vertical, widening upward, funnel-shaped, the membrane quite thick but gelatinous and almost invisible; paraphyses none; spores in 2's, ovoid to oblong and ovoid-ellipsoid, at first colorless, later pale brown, 28 to 40  $\mu$  long, 14 to 18  $\mu$  thick, muriform with 8 loculi in the longitudinal spore axis, and 3 or 4 in the transverse, the cells cubic; hymenial gelatine vinous red with iodine, the ascus membrane faintly so and its contents rich yellow to orange, sterigma indistinctly articulate, somewhat curved, spermatia minute, barely 1  $\mu$  long. The lower surface of the thallus is ecorticate; the upper has a cortex of horizontally flattened cells immediately beneath, these forming the gonidial layer.

On earth in open places. Type locality, foothills of the Santa Monica Mountains near the Soldiers' Home.

Type deposited with the late Dr. W. Nylander; duplicates in the U. S. National Herbarium, the herbarium of the New York Botanical Garden, and herb. Hasse.

**4. *Endocarpon wilmsoides* Zahlbr. Beih. Bot. Centralbl. 13: 152. 1902.**

Thallus of discrete or confluent small, round patches, 3 to 8 mm. in diameter, minutely rimulose, sooty olivaceous in color; apothecia solitary or 2 in the minute



thalline verrucæ, immersed, the apex dull black, the ostiole hardly visible, the perithecium obscurely brown, dimidiate; thecium pallid, globose; paraphyses distinct, filiform, subclavate above; asci 80 to 100  $\mu$  long, 29 to 32  $\mu$  thick, the membrane thickened at apex; spores in 2's, at first colorless, later brownish, ovoid and oblong-ovoid, muriform, the loculi subglobose, 8 to 10 in the long spore axis and 3 to 5 in the transverse; spores 35 to 44  $\mu$  long, 14 to 21  $\mu$  thick, staining yellow with iodine, the hymenial gelatine a coppery brown.

Type locality in the Santa Monica Mountains near Encino, on argillaceous schist.

Type deposited with Dr. A. Zahlbruckner; duplicates distributed to the late Prof. Clara Cummings, Rev. C. H. Demetrio, Dr. A. C. Herre, and Dr. B. de Lesdain, and in herb. Hasse.

**5. *Endocarpon monicae* Zahlbr. Beih. Bot. Centralbl. 13: 153. 1902.**

Thallus effuse, thin, of minute, olivaceous-cinerascent, subverruculose squamules, loosely aggregated, the fertile ones being slightly larger, containing one or two apothecia, these subimmersed, dull black, the ostiole barely visible; perithecium dark, dimidiate; thecium pallid, globose, 240 to 270  $\mu$  in diameter; hymenial gonidia numerous; paraphyses gelatinous; asci saccate-clavate or clavate, 120 to 140  $\mu$  long, 24 to 28  $\mu$  thick, the membrane above slightly thickened; spores in 2's or 3's, oval, oval-oblong, or oblong, muriform, pale brownish, 26 to 55  $\mu$  long, 10 to 20  $\mu$  thick, 8 to 14 cells in the long spore axis, 4 or 5 in the transverse; hymenial gelatine with iodine a sordid greenish.

Type locality in the Santa Monica Mountains near Encino on argillaceous schist.

Type deposited with Dr. A. Zahlbruckner; duplicate in herb. Hasse.

## PYRENULACEAE.

Thallus crustaceous, uniform, ecorticate, devoid of rhizinæ; algal symbiont a *Chroolepus*; perithecia solitary (in our species), erect with a vertical aperture; spermatia exobasidial.

### KEY TO GENERA.

Paraphyses loosely branching and internetting or absent.... *ARTHOPYRENIA* (p. 11).

Paraphyses not branching, separate.

Asci 4 to 8-spored, the spores 2 to several-locular..... *PORINA* (p. 12).

Asci many-spored, the spores 2 and 4-locular..... *THELOPSIS* (p. 12).

## *ARTHOPYRENIA* Mass.

Paraphyses loosely branching and internetting or absent; spores 2 to 6-locular, colorless, ovoid or oblong.

### KEY TO SPECIES.

Apothecia minute..... 1. *A. parvula*.

Apothecia medium-large..... 2. *A. biformis*.

**1. *Arthopyrenia parvula* Zahlbr. Beih. Bot. Centralbl. 13: 149. 1902.**

Thallus epiphloeodal, thin, pale grayish, smooth, generally forming small patches; KHO—, Ca(ClO)<sub>2</sub>—; apothecia minute, separate, rarely grouped, globose, black, the base slightly covered by the thallus, monocarpous, the apex becoming later depressed and punctiform-perforated; perithecium entire, dark, internally pallid, staining yellow with iodine; paraphyses filiform, about 1.5  $\mu$  thick, 80 to 90  $\mu$  long, 9 to 11  $\mu$  thick; spores in 8's, disposed in one row, colorless, ovoid, bilocular, the loculi unequal, 14 to 16  $\mu$  long, 5 to 6  $\mu$  thick.

On *Umbellularia californica* in Malibu Canyon (the type locality) in the Santa Monica Mountains.



**2. Arthopyrenia biformis** (Borr.) Muell. Arg.

Thallus gray, smoothish or finely furfuraceous, diffuse; apothecia entire, conical-semiglobular, black, glistening, scattered, their base partly covered by minute thalline furfur; paraphyses slender, scantily branching, and loosely interwoven; asci cylindric,  $100\ \mu$  long,  $12\ \mu$  thick; hypothecium pallid; spores in 8's, bilocular, often parted unequally by the septa, slightly curved, ovoid to oblong-ovoid, 12 to  $17\ \mu$  long, 7 to  $8\ \mu$  thick; hymenial gelatine giving no reaction with iodine.

Santa Catalina Island on *Heteromeles arbutifolia*.

**PORINA** Ach.

Paraphyses not branching, separate; asci 4 to 8-spored, the spores 2 to several-locular. A single species found within our limits.

**1. Porina plumbaria** (Stizenb.) *Erg. 3. 1895.*

*Verrucaria plumbaria* Stizenb. Bull. Torrey Club **24**: 448. 1897.

*Verrucaria carpinea plumbaria* Nyl.; Hasse, Lich. South. Calif. 18. 1898.

Thallus thin, smooth, silver gray; apothecia numerous, dispersed; perithecium horny, black, shining, semiglobose with a minute aperture; paraphyses loosely netted-branching, distinct, permanent; hypothecium colorless; asci cylindric, straight,  $60\ \mu$  long,  $12\ \mu$  thick; spores fusiform, bilocular, the loculi equal, and in fully matured spores each locus constricted, mostly disposed in single file, or somewhat oblique, in some cases partly in two rows, 15 to  $20\ \mu$  long, 3.5 to  $4\ \mu$  thick; with iodine the hypothecium and protoplasm of the ascus contents staining yellow, except the ascus membrane, this with the spores and paraphyses not affected by the reagent.

Frequent in the Santa Monica Range on various smooth barks, principally on *Quercus agrifolia*.

**THELOPSIS** Nyl.

Asci many-spored, the spores 2 to 4-locular; otherwise as in *Porina*.

Represented with us by one species.

**1. Thelopsis subporinella** Nyl. sp. nov. in litt.

Thallus crustaceous, uniform, the hypothallus invisible; apothecia mostly crowded, embedded in soft, buff colored, thalline warts, solitary or sometimes 3 or 4 in a wart (without a stroma formation), a light brown ostiole situated at the apex of the globular thalline verruca; paraphyses not sharply defined but permanent, not branching, filiform; asci fusiform and broadly fusiform, membrane thin,  $180\ \mu$  long, 20 to  $30\ \mu$  thick, spores numerous in the spore sac, colorless, bilocular, oblong-ellipsoid, 13 to  $18\ \mu$  long, 6 to  $7\ \mu$  thick, the epispore thin, surrounded by a narrow halo; ascus contents and hypothecium staining pale amber with iodine, the ascus membrane and the spores and paraphyses not affected.

On *Umbellularia californica* in Malibu Canyon (type locality) of the Santa Monica Range.

**PYRENIDIACEAE.**

Thallus membranaceous, crustaceous-squamulose, or foliaceous, homœomerous or stratified, with Nostoc or Sirospion gonidia; perithecia simple, vertical.

**HASSEA** Zahlbr.

*Hassea* Zahlbr. Beih. Bot. Centralbl. **13**: 150. 1902.

"Thallus crustaceus, uniformis, hyphis medullaribus substrato affixus, rhizinis destitutus, homoeomericus, ecorticatus, gonidiis nostocaeis, glomerulosis. Apothecia pyrenocarpica, simplicia, gonidiis hymenialibus nullis, perithecio recto, fuligineo. Paraphyses laxa ramoso-connexae, parum conspicuae. Asci 8-spори. Sporae bacillares, simplices et hyalinae. Pycnoconidia ignota."



1. **Hassea bacillosa** (Nyl.) Zahlbr. Beih. Bot. Centralbl. 13: 150. 1902.

*Verrucaria bacillosa* Nyl.; Hasse, Lich. South. Calif. 19. 1898.

Thallus crustaceous, effuse, leprose-furfuraceous, subareolate-rimose, obscurely olivaceous brown, quite thin, no reaction with KHO or  $\text{Ca}(\text{ClO})_2$ , ecorticate; (according to the author of this new genus,) gonidia of the Nostoc type, embedded in a gelatinous mass and subconcatenate (3 or 4 cells connected); apothecia sessile, dispersed, 0.2 to 0.3 mm. wide, conical-semiglobose, black, somewhat glistening; perithecium erect, dimidiate, fuliginous, the ostiole punctiform, inconspicuous, at last lightly impressed; nucleus pallid, not changed by iodine; paraphyses lax, sparsely branched and connected; asci scarce, oblong-cuneate, straight or moderately curved, 43 to 48  $\mu$  long, 8 to 10  $\mu$  wide, the membrane not thickened; spores in 8's, arranged vertically, hyaline, simple, bacilliose, straight or nearly so, their apices rounded and slightly broadened, 30 to 40  $\mu$  long, 1.8 to 2.1  $\mu$  thick; spermatia not known.

On crumbling sandstone. Type locality, foothills of the Santa Monica Range near the Soldiers' Home.

Type deposited with Dr. W. Nylander; duplicates with Dr. A. Zahlbruckner and in herb. Hasse.

### MYCOPORACEAE.

Thallus crustaceous, uniform, with *Palmella* or *Chroolepus* gonidia; hymenium composite, divided by partitions, with apical apertures.

Based upon the characters of the spores two genera have been formed: *Mycoporum*, with *Palmella* gonidia and muriform spores and *Mycoporellum*, with *Chroolepus* gonidia and bilocular spores. Two species of the latter genus concern us as sole representatives in southern California.

### MYCOPORELLUM Muell. Arg.

Gonidia *Chroolepus*; spores bilocular.

#### KEY TO SPECIES.

Thallus absent; apothecia parasitic on other lichens..... 1. *M. epistigmellum*.

Thallus present, whitish, diffuse..... 2. *M. hassei*.

1. ***Mycoporellum epistigmellum*** sp. nov.

*Mycoporum epistigmellum* Nyl. in litt.

Thallus absent; apothecia parasitic upon disks of *Blastenia festiva* and on the thallus of *Acarospora obpallens* and *A. chlorophana*; paraphyses absent; asci oblong-ellipsoid and oblique-ellipsoid, acuminate at the tops, the membrane there thickening, straight or slightly curved, 48 to 56  $\mu$  long, 14 to 15  $\mu$  thick; spores in 8's, bilocular, colorless, oblong-ellipsoid, 16 to 20  $\mu$  long, 3.5 to 4  $\mu$  thick, the lower loculus narrower and more acuminate than the other; asci stained yellow by iodine.

Type locality, foothills of Santa Monica Range near the Soldiers' Home.

Type deposited with Dr. W. Nylander; duplicate in herb. Hasse.

2. ***Mycoporellum hassei*** Zahlbr. sp. nov. in litt.

Thallus whitish colored, diffuse, thinly squamulose; apothecia scattered, 0.4 to 1 mm. wide, dull black, flattish, under the hand lens seen finely papillate; paraphyses absent; asci oblong-ellipsoid, 60 to 80  $\mu$  long, 20 to 28  $\mu$  thick, the membrane about 3  $\mu$  thick, the upper attenuate part solidly thickened; spores in 8's, colorless, bilocular, oblong, 20 to 28  $\mu$  long, 8 to 10  $\mu$  thick, the lower loculus slightly thinner and longer than the upper; hymenial gelatine staining pale yellow with iodine, the ascus contents pale vinous red; no change with KHO.



Dr. A. Zahlbruckner writes: "Von den übrigen Mycoporellum Arten mit zweizelligen, farblosen Sporen durch die grosse Zahl der Mündungen des Apotheciums (15-18) unterschieden, ausserdem von *M. lahmii* durch kleinere Sporen und von *M. ellipticum* durch die nicht zylindrischen Sporen abweichend; am nächsten kommt sie noch der *M. eschweileri*, doch diese hat nur wenig Osteola."

Type locality, Santa Catalina Island near Avalon, on *Crossosoma californicum*.

Type deposited with Dr. A. Zahlbruckner; duplicate in herb. Hasse.

### Order GYMNOCARPEAE.

Disk round or narrowed and lengthened (lirellaeform), more or less exposed, not covered by the margin (exciple), covered, however, by the prolonged and densely interwoven paraphyses forming a "capillitium," these becoming intermingled with the soon liberated spores, forming the so-called "mazædium."

#### KEY TO SUBORDERS.

- Paraphyses and spores forming a mazædium..... CONIOCARPINEAE (p. 14).  
 Paraphyses and spores not forming a mazædium.  
     Disk linear to elongate and ellipsoid ..... GRAPHIDINEAE (p. 16).  
     Disk circular..... CYCLOCARPINEAE (p. 29).

### Suborder CONIOCARPINEAE.

Thallus partaking of the cardinal forms, foliaceous, crustaceous or fruticulose; symbionts Pleurococcus, Protococcus, Stichococcus, or Chroolepus gonidia; disk exposed, roundish or elongate; asci cylindric, soon disintegrating and forming a mazædium with the liberated spores.

#### KEY TO FAMILIES.

- Apothecia stipitate..... CALICIACEAE (p. 14).  
 Apothecia sessile..... CYPHELIACEAE (p. 15).

### CALICIACEAE.

Thallus thinly crustaceous, granulose or wanting; gonidia as above, excluding Chroolepus; apothecia stipitate or sessile, with more or less globose heads.

#### KEY TO GENERA.

- Apothecia not stipitate, sessile or subsessile..... SPHINCTRINA (p. 15).  
 Apothecia stipitate.  
     Disk open..... CALICIUM (p. 14).  
     Disk inclosed, punctiform..... STENOCYBE (p. 15).

### CALICIUM Pers.

Thallus crustaceous, granular to warty; apothecia stipitate, the disk open.

#### KEY TO SPECIES.

- Thallus granulose, greenish yellow, effuse..... 1. *C. hyperellum*.  
 Thallus macular or absent, if present grayish..... 2. *C. parietinum*.

#### 1. *Calicium hyperellum* Ach.

Thallus greenish yellow, granular or leprose; apothecia on black stipes, the heads globose-lenticular, beneath brownish; spores 8, blackish, ellipsoid, bilocular, one locus generally narrowed, 11 to 16  $\mu$  long, 5 to 8  $\mu$  thick, becoming dark brown with maturity; paraphyses free, some forked above; asci clavate or tubular, 40  $\mu$  long,



10  $\mu$  thick, upon a podetium almost equally long; hypothecium sienna brown; hymenial structures staining yellow with iodine.

On bark of conifers, Yosemite Valley; on *Pseudotsuga macrocarpa* in the San Gabriel Range.

## 2. *Calicium parietinum* Ach.

Thallus insignificant or absent; apothecia globose-lenticular, the under side and the stipe brownish black, the somewhat more flattened upper surface black, overreaching the margin a little; asci cylindric; spores in 8's, simple, grayish to light brown, ellipsoid, 7 to 10  $\mu$  long, 4 to 5  $\mu$  thick.

On dead, decorticated oak, Strawberry Valley in the San Jacinto Mountains, and on dead *Sambucus* in canyons of the Santa Monica Range.

## STENOCYBE Nyl.

Thallus absent; apothecia stipitate, the disk open.

### 1. *Stenocybe tremulicola* Norrl.

Apothecia globular, with a minute punctiform aperture, on a short, slender stipe; differing from *S. byssacea* Fries in the smaller spores, these in our species 12 to 18  $\mu$  long, 4 to 5  $\mu$  thick, nigrescent, oblong-ellipsoid, and bilocular to quadrilocular.

On smooth bark of limbs of *Juglans californica* in canyons of the Santa Monica Range.

According to Hue, Nylander makes this a subspecies of *Stenocybe byssacea* Fries.

## SPHINCTRINA Fries.

Thallus absent; apothecia sessile or subsessile.

### KEY TO SPECIES.

- |                                     |                             |
|-------------------------------------|-----------------------------|
| Apothecia sessile or nearly so..... | 1. <i>S. microcephala</i> . |
| Apothecia short-stipitate.....      | 2. <i>S. turbinata</i> .    |

### 1. *Sphinctrina microcephala* Nyl.

Apothecia black, globular; spores simple, ellipsoid, brown, 9 to 12  $\mu$  long, 6 to 8.5  $\mu$  thick; asci tubular; paraphyses filiform; hymenial gelatine staining indigo blue with iodine.

Parasitic on thallus of *Pertusaria lecanina* and *P. pustulata* on bark of *Quercus agrifolia* in the Santa Monica Range.

### 2. *Sphinctrina turbinata* Fries.

Thallus absent; apothecia short-stipitate; spores globular, brown, simple, 6 to 8  $\mu$  in diameter; asci tubular, 56  $\mu$  long, 6 to 8  $\mu$  thick; paraphyses separate, shorter than the asci; hymenial gelatine giving no reaction with iodine.

On thallus of *Cyphelium bolanderi*, Ballona Bluffs near Santa Monica.



Thallus crustaceous, uniform; gonidia.

Protococcus, and Chroolepus

Thallus thin, granulose or verrucose, uniform or becoming effigurate at the periphery; apothecia sunken in the thalline verrucæ, eventually the disk expanding and open; paraphyses few, filiform; asci clavate; spores in 8's, arranged in one row, bilocular, rarely with more cells or simple.

### KEY TO SPECIES.

- |                              |                          |
|------------------------------|--------------------------|
| Spores simple.....           | 1. <i>C. bolanderi</i> . |
| Spores bilocular.            |                          |
| Thallus greenish yellow..... | 2. <i>C. tigillare</i> . |
| Thallus light gray.....      | 3. <i>C. inquinans</i> . |



1. *Cyphelium bolanderi* (Tuck.) Zahlbr. in Engl. & Prantl. Nat. Pflanzenfam. 1<sup>1\*</sup>: 84. 1907.

*Acolium bolanderi* Tuck. Syn. N. Amer. Lich. 136. 1888.

Thallus light grayish buff or grayish ochraceous, the warts more or less approximate, at times showing a tendency to lobation at their peripheries, a narrow, delimiting, black hypothalline border not always present; paraphyses filiform; asci torulose-cylindrical, containing 8 spores, these simple, at first colorless, at last brown to dark brown, from 9 to 20  $\mu$  in diameter, the greater number of medium size and showing a round central gray spot, the larger of a uniform dark brown; hymenial structures giving no reaction with iodine or with KHO.

Frequent on various rocks in southern California.

In reply to lichens sent him, the late Doctor Stizenberger wrote, in 1898, regarding this species: "*Acolium bolanderi* (olivenfarbige Thalluswarzen mit weissberandetem Sporenhäufchen)=äechtes *A. bolanderi*, aber Tuckerman hat hier einen groben Fehler begangen, wie früher Körber und Hepp ihn bei ähnlichen Gebilden auch machten (ebenso der alte Fée). Sie sahen einen parasitischen Hyphomyceten für Caliciaceen an. Wir haben hier einen Rostpilz auf dem Thallus von *Lecanora angelica* Stiz. vor uns." Again, later in the same year, he wrote: "*Acolium bolanderi* ist ein Uredo-ähnlicher Pilz und keine Flechte."

2. *Cyphelium tigillare* (Pers.) T. Fries.

Thallus greenish yellow, granulate or loosely areolate, effuse; apothecia innate to subsessile, the disk black, flat; asci cylindric; paraphyses few, separate; spores 8, bilocular, constricted, 11 to 24  $\mu$  long, 7 to 12  $\mu$  thick, smoky gray to brown with a round gray spot in each locus.

On dead pine wood, San Jacinto Mountains; dead shrubs near Murietta; dead wood, Tehachapi Mountains.

3. *Cyphelium inquinans* (J. E. Smith) Trevis.

Thallus whitish to light gray, granulose, often indistinct; apothecia small, sessile, a thalline margin indistinct, disk dull black, flat; spores bilocular, light brown to dark brown in the largest, constricted, 13 to 24  $\mu$  long, 7.5 to 11  $\mu$  thick; gonidia Protococcus, large.

On bark of conifers in the Tehachapi Mountains.

### Suborder GRAPHIDINEAE.

Thallus crustaceous, passing from corticate, or with a defective cortex, to higher developed forms with a distinct cortex and finally to fruticose states with a pronounced medullary layer and cortex; the crustaceous forms affixed to the substrate by medullary or hypothalline hyphæ, the fruticose by means of a basal disk; gonidia consisting of Palmella or Chroolepus algæ (lichens of this class in symbiosis with Phycopeltis or Phyllactidium algæ having not yet been found with us); apothecia marginless (Arthoniaceae), or with a more or less distinct proper margin, and some with a distinct thalline margin, immersed or subpedicellate (Roccellaceae), sometimes roundish or circulate, the dominant form elongate or linear with a fissure-like (rimæform) disk, distinct (the greater part) or combined in a stroma; hypothecium generally dark and carbonaceous; paraphyses entire and free, or branching and interlacing; spores colorless or dark, of varying form and septation, the fusiform shape prevailing; spermatia in some genera not known, but not rare in Arthoniaceae, Roccellaceae, and Dirinaceae.







Spores 4 to 8-locular; growing on bark—Continued.

Thallus thin, smooth, some shade of gray—Continued.

Apothecia not pruinose.

Outline entire, round to roundish.

Large, prominent..... 7b. *A. radiata swartziana*.

Small, less prominent.

Not innate in thallus.

Crowded, black when moist..... 15. *A. lecanactidea*.

Not crowded.

Black when moist..... 12. *A. punctiformis*.

Gray when moist ..... 10. *A. diffusa*.

Innate in thallus..... 13. *A. epipastoides*.

Outline not entire.

Stellate-radiate..... 7. *A. radiata*.

Elongate-linear.

Conspicuously branching and curved.. 7a. *A. radiata angustata*.

Not conspicuously branching..... 8. *A. stictella*.

Not elongate, short-linear..... 6. *A. tetramera*.

### 1. *Arthonia microspermella* Willey.

Thallus whitish or silver gray, thin, effuse; apothecia small, round or oblong, numerous, brownish black; asci oblong-ovoid to subglobular, 36 to 40  $\mu$  long, 18 to 20  $\mu$  thick; spores in 8's, colorless, 2 or 3-locular, 13 to 14  $\mu$  long, 4 to 4.5  $\mu$  thick; hymenial gelatine blue with iodine, the asci and contents yellow.

On *Juglans californica*, in canyons of the Santa Monica Mountains. A type specimen not being available for comparison, the determination of the Californian lichen is subject to correction.

### 2. *Arthonia glebosa* Tuck.

Thallus thickish, of bullous, separate or connected and plicate, convex and rounded, pale dun colored squamules; apothecia black, roundish or oblong, convex, smooth, interspersed and becoming conglomerate between the thalline squamules; epithecium subcontinuous, light brown; thecium light brown, 48 to 52  $\mu$  high; hypothecium dark brown and thick; paraphyses intricately interwoven; asci subinflated-clavate, the membrane slightly thickened above, 36 to 38  $\mu$  long, 12 to 15  $\mu$  thick; spores in 8's, 12 to 16  $\mu$  long, 4 to 5  $\mu$  thick, bilocular, the upper loculus round or ovoid, the lower narrower and slightly longer; hymenial gelatine with iodine orange to copper brown.

A most singular-appearing *Arthonia*.

Mesas on earth. Collected by C. R. Orcutt in Lower California.

### 3. *Arthonia subdispuncta* Nyl.; Hasse, Bull. Torrey Club 24: 448. 1897.

Thallus sordid white, subfarinaceous, effuse, hypothallus pale; apothecia bluish black, small, angular, oblong or irregularly round, about 0.1 mm. wide, sessile or subinnate; epithecium coarsely granulose, bluish gray; thecium colorless 28 to 30  $\mu$  high; paraphyses obscure; asci broadly spatulate to pyriform, 30 to 34  $\mu$  long, 16  $\mu$  thick; spores oblong-ellipsoid, bilocular, not constricted, attenuate at one end, the other end blunt, 11  $\mu$  long, 4  $\mu$  thick; hymenial gelatine with iodine pale yellow.

On caudex of *Leptosyne gigantea*; beach bluffs at Point Dume, Santa Monica Mountains. Type deposited in the U. S. National Herbarium; duplicate in herb. Hasse.

### 4. *Arthonia galactitella* Nyl.

Thallus forming cream-colored spots, irregular in outline and 1 to 2 cm. wide, finely furfuraceous; apothecia numerous, small, slightly erumpent, flat, somewhat pruinose, round, or, as if by aggregation of several, oblong; asci oblong-ovate; membrane thick-



ened at apex, 32 to 44  $\mu$  long, 14 to 16  $\mu$  thick; spores in 8's, oblong-ellipsoid, 4-locular, not constricted, the upper loculus largest, the others equal in length, one end blunt, the other attenuated, 13 to 16  $\mu$  long, 5 to 5.2  $\mu$  thick; paraphyses absent; hymenial gelatine with iodine stained a coppery red.

On bark of apricot and oleander, Soldiers' Home grounds (near Santa Monica).

**5. *Arthonia rhoidis* Zahlbr. Beih. Bot. Centralbl. 13: 156. 1902.**

Thallus thin, effuse, pale pinkish; apothecia immersed, black, slightly pruinose, from punctiform to irregularly roundish or oblong; epithecium granulose, blackish with a bluish tinge; paraphyses coherent and interwoven; thecium 56 to 60  $\mu$  high, colorless; hypothecium pallid; asci 40 to 46  $\mu$  long, 12 to 18  $\mu$  thick; spores in 8's, oblong-ellipsoid, 3-locular, the two septa approximate near the middle of the spore, 13 to 14  $\mu$  long, 5 to 6  $\mu$  thick; hymenial gelatine and spore sacs with iodine a violet blue, the contents of the latter and the spores yellow to orange.

Type locality, Santa Catalina Island on bark of *Rhus laurina*. Type deposited with Dr. A. Zahlbruckner; duplicates in the U. S. National Herbarium and in herb. Hasse.

The writer has subsequently found this species on *Grevillea robusta* on the Soldiers' Home grounds and on *Salix lasiolepis* and *Platanus racemosa* in canyons of the Santa Monica Range. The thallus of the mainland form is whitish and smoother than the insular type, but spore measurements and chemical reaction are identical.

**6. *Arthonia tetramera* (Stizenb.).**

*Arthonia dispersa tetramera* Stizenb.; Hasse, Bull. South. Calif. Acad. 2: 35. 1903.

Thallus silvery white, thin, subfarinaceous, limited by a thin, black border; apothecia with a delicate, spurious thalline margin, linear and variously branching, numerous; epithecium finely granulose, bluish black; thecium 64 to 68  $\mu$  high, colorless; paraphyses indistinct; asci pyriform, 28 to 32  $\mu$  long, 12 to 16  $\mu$  thick; spores in 8's, oblong-ellipsoid, attenuate at one end, 4-locular, not constricted, the epispore thin, 11 to 14  $\mu$  long, 4 to 5  $\mu$  thick; hymenial gelatine with iodine blue, soon dark orange red; spermatogones not seen.

On *Lonicera subspicata*, Santa Catalina Island. Type specimen in herb. Hasse.

**7. *Arthonia radiata* (Pers.) Ach.**

Thallus mostly whitish to light gray, rarely pale cream or flesh color, consisting of smooth, indeterminate, irregular roundish patches from 3 to 4 or more centimeters in diameter; apothecia black, flat, appressed, more or less radiately lobed or divided; asci pyriform; spores in 8's, 4-locular, oblong-ellipsoid, 14 to 18  $\mu$  long, 5 to 7  $\mu$  thick; hymenial gelatine with iodine blue, then vinous red, the asci and spores yellow.

On various barks, common. Cosmopolitan.

**7a. *Arthonia radiata angustata* Wain.**

Apothecia linear, simple or branching, the thallus limited by a black hypothalline line; measurements and reactions as in the species.

On caudex of *Leptosyne gigantea*, on San Nicolas Island, *Trask*; on the smooth bark of *Quercus agrifolia* and *Heteromeles arbutifolia* in the Santa Monica Mountains.

**7b. *Arthonia radiata swartziana* (Ach.) Willey.**

Thallus whitish to gray, similar to the species; apothecia dull black and black, roundish, less distinctly radiate and more crowded, flat; epithecium granulose, dark gray; thecium colorless or sordid, 68 to 80  $\mu$  high; paraphyses indistinct; hypothecium pallid or grayish; asci pyriform, the membrane much thickened above, 44 to 60  $\mu$  long, 22 to 24  $\mu$  thick; spores oblong-ovoid, 4-locular, blunt at the ends, 16 to 20  $\mu$  long, 7  $\mu$  thick, with a halo; hymenial gelatine with iodine blue—including the hymenial structures (the spores yellow or pale orange).

On various barks, like the species widely distributed in southern California but less frequent.



**8. *Arthonia stictella* Stizenb.**

*Arthonia stictella* Stizenb.; Hasse, Bull. South. Calif. Acad. 2: 34. 1903, nomen nudum.

Thallus epiphloeodal, sordid whitish, subfurfuraceous; apothecia parallel, lirellate, black; thecium about 60  $\mu$  high, pallid; paraphyses intricate, indistinct; asci pyriform with a thick membrane, especially above, 60  $\mu$  long, 20  $\mu$  thick; spores in 8's, colorless, oblong, finger-shaped, both ends rounded, 6-locular, the loculi somewhat lenticular, 20 to 26  $\mu$  long, 6 to 7  $\mu$  thick; iodine staining the epithecium deep blue and the hymenial gelatine deep orange red; spermogones not seen.

On bark of *Lonicera subspicata*, Santa Catalina Island. Type in herb. Hasse.

**9. *Arthonia pruinosa* Nyl.; Hasse, Lich. South. Calif. 16. 1898.**

Thallus thick, epiphloeodal, white to pale cream color, of roundish patches 1.5 cm. or less wide, furfuraceous; spermatia straight, staff-shaped, 8 to 10  $\mu$  long, 1  $\mu$  thick; apothecia numerous, small, about 0.1 mm. wide, flat, round, black or mostly white pruinose; epithecium granulose, dark ashy gray; paraphyses indistinct; asci oblong-ovoid, 28 to 36  $\mu$  long, 12 to 16  $\mu$  thick, the membrane thick especially above; spores in 8's, oblong-ellipsoid, bilocular, not constricted, the episore thin, 13 to 16  $\mu$  long, 4 to 5  $\mu$  thick; hymenial gelatine with iodine pale vinous red, the contents of the asci yellowish.

On bark of *Cordia* sp., a small South American tree cultivated at the Agricultural Experiment Station near Santa Monica.

Type deposited with the late Dr. W. Nylander; duplicates in the U. S. National Herbarium, with Dr. A. Zahlbruckner, and in herb. Hasse.

**10. *Arthonia diffusa* Nyl.**

Thallus white, finely granulose or furfuraceous, epiphloeodal, diffuse; apothecia small (about 0.2 mm. wide), black, when moistened yellow gray and semitranslucent; epithecium granulose, gray, after iodine bluish gray; thecium colorless, 50 to 54  $\mu$  high; asci pyriform, 36 to 44  $\mu$  long, 14 to 18  $\mu$  thick, the upper part thickened; spores 4-locular, ovoid-oblong, 13 to 16  $\mu$  long, 3.5 to 4.5  $\mu$  thick; hymenial gelatine pale claret with iodine, the spores yellow.

On *Malvastrum fasciculatum*, in canyons of the Santa Monica Mountains.

**11. *Arthonia subdiffusa* Willey.**

Thallus whitish, thin, in small round or oblong maculae, 1 to 2 cm. wide, with KHO reddish yellow, with  $\text{Ca}(\text{ClO})_2$  unchanged; apothecia very minute, round or oblong, slightly projecting, black, flat, quite densely pruinose, very similar in appearance to those of *Allarthonia patellulata caesiocarpa* Zahlbr., the latter, however, round and convex; epithecium graphite color, subgranulose; thecium colorless, 40 to 44  $\mu$  high; hypothecium colorless; paraphyses distinct; asci oblong-ovoid, 40  $\mu$  long, 20  $\mu$  thick; spores in 8's, narrowly oblong-ovoid, 4-locular, the loculi equal, attenuate at one end, 16 to 18  $\mu$  long, 4 to 5  $\mu$  thick; hymenial gelatine with iodine pale vinous red, the spores yellow.

On *Malvastrum fasciculatum* in the Santa Monica Mountains.

**12. *Arthonia punctiformis* Ach.**

Thallus hypophloeodal, effuse, gray to dull reddish brown; apothecia black, plano-convex, round or oblong; asci ovoid-oblong, 48  $\mu$  long, 20  $\mu$  thick; spores in 8's, 4-locular, oblong-ellipsoid, 22 to 24  $\mu$  long, 7 to 8  $\mu$  thick, rounded at each end, narrowed at one end; reaction with iodine a dark vinous red.

On various smooth barks, widely distributed; Santa Cruz Mountains, Herre, San Bernardino, Parish; frequent in the Santa Monica Mountains.

**13. *Arthonia epipastoides* Nyl.**

Thallus epiphloeodal, silvery white, somewhat furfuraceous or minutely scaly, effuse; apothecia minute, punctiform, irregularly roundish or angular, impressed;



hypothecium colorless; asci ovoid,  $40\ \mu$  long,  $20\ \mu$  thick, the membrane thickened above; spores in 8's, oblanceolate, 2 or 3-locular, or mostly 4-locular, 20 to  $40\ \mu$  long, 6 to  $7\ \mu$  thick, straight or lightly curved, one end long-attenuate; asci with iodine pale violet, the spores yellow.

On California holly, walnut, and *Rhus laurina*, in canyons of the Santa Monica Mountains.

**14. *Arthonia impolita* (Ehrh.) Borr.**

Thallus white to silvery gray, effuse, moderately thick, pulverulent, KHO—,  $\text{Ca}(\text{ClO})_2$ +red; apothecia numerous, at times confluent, flesh-colored to light reddish brown, subinnate and sessile, flat, roundish, oblong, or even lobulate to wavy in outline, with a thin spurious thalline margin, somewhat pruinose, when moist tumid and light yellowish brown; epithecium yellowish gray or brownish and granulose; thecium colorless, 48 to  $52\ \mu$  high; paraphyses indistinct; hypothecium colorless; asci wedge-shaped,  $44\ \mu$  long,  $24\ \mu$  thick, the membrane thickened above; spores colorless, oblong-ovoid, 13 to  $20\ \mu$  long, 5.5 to  $8\ \mu$  thick, 4 to 5-locular, the extreme loculi slightly larger than the central; reaction with iodine blue, including the epithecium and hypothecium, changing to red brown, the ascus protoplasm and spores yellow.

Santa Catalina Island on California holly and walnut bark; on various barks on the mainland, Santa Monica Mountains; on shrubs at Newport and White Point near San Pedro.

**14a. *Arthonia impolita chiodectonoides* Tuck.**

Thallus white, creamy, furfuraceous, in rounded patches, 1.5 to 6.5 cm. wide, without a limiting black hypothallus; no reaction with iodine; apothecia small, roundish, often several congregated, dark flesh-colored, densely pruinose or covered by thallus; epithecium light yellowish gray, not granulose; thecium colorless, 40 to  $48\ \mu$  high; asci cuneate, 36 to  $40\ \mu$  long, 16 to  $20\ \mu$  thick, the membrane thickened above; spores in 8's, oblong-ovoid to oblong-ellipsoid, colorless, 4 or 5-locular, the end loculi slightly larger than the others.

Near Newport on the cortex of dead *Opuntia*; on shrubs at White Point near San Pedro.

In view of the differing reaction this might rank as a species.

**15. *Arthonia lecanactidea* Zahlbr. Beih. Bot. Centralbl. 13: 155. 1902.**

Thallus creamy white, epiphloeodal, effuse, medium thick, finely rimose; apothecia numerous, often crowded, dull black, planoconvex, slightly raised above the thallus, from 0.3 to 0.5 mm. wide; epithecium subgranulose, brownish dark gray; thecium 76 to  $80\ \mu$  high, colorless; paraphyses coherent, intricately interwoven; hypothecium pallid; asci cuneate,  $52\ \mu$  long,  $16\ \mu$  thick, the upper part thickened; spores in 8's, bilocular, oblong, the lower cell slightly attenuate, 10 to  $14\ \mu$  long, 3.5 to  $4\ \mu$  thick; hymenial gelatine with iodine pale violaceous, the spores light orange.

On *Lycium californicum*. Type locality, bluffs at White Point near San Pedro. Also collected on Santa Catalina Island on the same substrate, at the isthmus.

Type deposited with Dr. A. Zahlbruckner; duplicate in herb. Hasse.

**16. *Arthonia gyalectoides* Muell. Arg.**

Thallus white, furfuraceous, slightly roughened or granular, effuse; apothecia 0.5 to 0.8 mm. wide, flesh-colored, flat or concave, roundish, somewhat flexuose in outline or quite irregular, white pruinose, appressed, surrounded by a slightly raised false thalline margin, the moistened disk paler and translucent; thecium colorless; epithecium granulose; thecium with epithecium  $60\ \mu$  high; hypothecium pallid; paraphyses indistinct; asci pyriform to balloon-shaped, about  $36\ \mu$  long,  $24\ \mu$  thick, the membrane thickened above; spores in 8's, ovoid-oblong, rounded at both ends, attenuate toward one end, 5-locular, the upper loculus the larger, 16 to  $22\ \mu$  long, 7 to  $8\ \mu$  thick;



hymenial gelatine with iodine blue, soon vinous red, the spores becoming pale yellow; thallus with KHO—,  $\text{Ca}(\text{ClO})_2$ +red.

Santa Catalina Island on California holly and walnut; canyon of Santa Monica Mountains on *Quercus agrifolia*.

**17. *Arthonia polygramma* Nyl.**

Thallus white, thin, effuse, subfurfuraceous, KHO+ yellow, then reddish,  $\text{Ca}(\text{ClO})_2$ —; apothecia brown, innate, flat or slightly concave, pruinose, irregularly round or oblong in outline, deeply radiately incised (as seen better when moist, the pruina then transparent), and reddish brown; epithecium granulose, yellowish gray; thecium about  $60\ \mu$  high, colorless to a pale brownish hue; hypothecium brownish yellow; asci balloon-shaped, the membrane thickened above; spores in 6's (?), ovoid-oblong, rounded at both ends, 5 or 6-locular, 16 to  $23\ \mu$  long, 6 to  $8\ \mu$  thick, the epispore thick, the end cells, especially the upper, larger than the middle ones; paraphyses indistinct; hymenial gelatine with iodine a rich reddish brown.

Santa Catalina Island on *Rhus diversiloba*; on oak bark, Santa Cruz Mountains, Herre.

**ALLARTHONIA Nyl.**

Thallus with *Palmella* gonidia; otherwise as in *Arthonia*.

**1. *Allarthonia patellulata* (Nyl.) Zahlbr. in Engl. & Prantl. Nat. Pflanzenfam. 1<sup>1\*</sup>: 91. 1907.**

*Arthonia patellulata* Nyl. in Nya Bot. Notis. **1853**: 95. 1853.

Thallus pale cream color, effuse, continuous, epiphloeodal; apothecia round or slightly oblong, black, small, appressed or slightly projecting; asci ovoid or oblong-ovoid, 32 to  $36\ \mu$  long,  $20\ \mu$  thick, the upper part of the membrane thickened; spores in 8's, bilocular, oblong and constricted, 12 to  $15\ \mu$  long, 4 to  $5\ \mu$  thick, the loculi equally parted but the lower narrower and somewhat attenuate; hymenial gelatine blue with iodine, also the ascus membrane, but contents and spores yellow.

On *Malvastrum fasciculatum*, Santa Monica Mountains.

**1a. *Allarthonia patellulata caesiocarpa* (Zahlbr.).**

*Arthonia patellulata caesiocarpa* Zahlbr. Bull. Torrey Club **27**: 646. 1900.

Thallus thin, white; apothecia pruinose; hypothecium pale; "spores 15 to  $17\ \mu$  long, 5.5 to  $6\ \mu$  thick."

Type locality, Sepulveda Canyon, Santa Monica Mountains, on the same host as the species.

Type deposited with Dr. A. Zahlbruckner; duplicate in herb. Hasse

**ARTHOTHELIUM Mass.**

Differs from the genus *Arthonia* only in having muriform spores.

**KEY TO SPECIES.**

- |   |                             |
|---|-----------------------------|
| Apothecia pruinose, round or nearly so..... | 3. <i>A. pruinascens</i> .  |
| Apothecia not pruinose.                     |                             |
| Dark red or brown.....                      | 4. <i>A. sanguineum</i> .   |
| Black.                                      |                             |
| Round or oval.                              |                             |
| Grouped in circles.....                     | 1. <i>A. orbiliferum</i> .  |
| Not grouped in circles.....                 | 2. <i>A. taediosum</i> .    |
| Irregularly or indistinctly radiate.....    | 5. <i>A. anastomosans</i> . |

**1. *Arthothelium orbiliferum* Almq.**

Thallus whitish to leaden gray, smooth, thin, epiphloeodal in roundish patches without a limiting black line, KHO—,  $\text{Ca}(\text{ClO})_2$ —; apothecia round, small, black, flat, disposed in a more or less interrupted circle; epithecium bluish black, nongranu-



lose; paraphyses indistinct (not well defined); asci pyriform, the membrane thickened above; spores 6 to 8, oblong-ovoid, 21 to 27  $\mu$  long, 10 to 15  $\mu$  thick, muriform, colorless, with 6 transverse septa and 2 or 3 in the longitudinal spore axis, one or both end cells divided into 2 or 3 triangular cells; spermogones marked by a minute black projection; sterigma simple, straight; spermatia acicular, straight, 6 to 8  $\mu$  long and about 1  $\mu$  thick; with iodine the ascus membrane staining vinous red, the spores yellow, the other thecial structures blue.

Santa Catalina Island on California holly; also on the mainland (Santa Monica Mountains) on the same host and on wild walnut.

## 2. *Arthothelium taediosum* Nyl.

Thallus smooth, thin, white to light grayish, limited by an indistinct black line, KHO+yellow, Ca(ClO)<sub>2</sub>—; apothecia black, innate, irregularly substellate or oblong-roundish in outline, when moistened a little erumpent and under the lens internally reddish brown; paraphyses not sharply defined; asci pyriform, 56 to 68  $\mu$  by 24 to 48  $\mu$ , the upper part thickened; spores 6 to 8, muriform, colorless, oblong-ellipsoid, 24 to 32  $\mu$  long, 11 to 15  $\mu$  thick, with transverse septa and 2 or 3 in the long spore axis, the extreme cells divided into 2 or 3 parts; reaction with iodine blue, the ascus membrane pale vinous red, the spores yellow.

In the Santa Monica Mountains on bark of *Platanus racemosa*, also on *Juglans californica* and *Heteromeles arbutifolia*; on *Rhus diversiloba*, at Highland Park near Pasadena.

## 3. *Arthothelium pruinascens* Zahlbr. Bull. Torrey Club 27: 646. 1900.

Thallus sordid whitish, rugulose, determinate but irregularly spreading; apothecia innate to sessile, white-pruinose, round to oblong, flat; paraphyses not sharply defined; thecium light yellowish brownish, about 80  $\mu$  high; asci balloon-shaped, 72 to 75  $\mu$  long, 36  $\mu$  thick, the upper part much thickened; hypothecium yellow; spores in 8's, colorless, broadly oblong-ellipsoid, muriform, 18 to 22  $\mu$  long, 7 to 12  $\mu$  thick; transverse septa 7 with 3 or 4 in the long spore axis; iodine staining epithecium, thecium, and hypothecium a deep blue, the ascus membrane pale vinous red and the spores yellow.

Type locality Sepulveda Canyon, Santa Monica Mountains. On *Malvastrum fasciculatum*. Occasionally also on the bark of *Ceanothus divaricatus* and other barks.

## 4. *Arthothelium sanguineum* (Willey) Zahlbr. in Engl. & Prantl, Nat. Pflanzenfam. 1<sup>1\*</sup>: 91. 1907.

*Arthonia sanguinea* Willey, Syn. Arth. 22. 1890.

Thallus milk white, effuse, subfurfuraceous, epiphloeodal, KHO+yellow, Ca(ClO)<sub>2</sub>—; apothecia appressed, dark red brown, convex, erumpent, round or oblong, in the juvenile state white pruinose; epithecium sordid yellowish; thecium about 60  $\mu$  high; hypothecium colorless; asci pyriform with a thick membrane, 40 to 52  $\mu$  long, 20 to 24  $\mu$  thick; spores colorless, ovoid-oblong, 20 to 30  $\mu$  long, 14 to 20  $\mu$  thick; reaction with iodine blue, the spores pale scarlet; spermogones marked by a black punctiform projection, sterigma short, straight; spermatia staff-shaped, straight, 6 to 10  $\mu$  long, 1  $\mu$  thick.

## 5. *Arthothelium anastomosans* (Ach.) Nyl.

Thallus white or silvery gray, smooth or lightly rugulose, epiphloeodal, determinate, in rounded patches without a black hypothalline border; apothecia small, black, innate, irregularly stellate or indistinctly radiate, epruinose or finely white pruinose at the margin; epithecium yellowish brown, not granulose; thecium 48 to 52  $\mu$  high, colorless or with a faint yellow hue; paraphyses not sharply defined; hypothecium colorless; asci balloon-shaped, 40  $\mu$  long, 36  $\mu$  thick, the upper part of membrane thickened; spores in 8's, ovoid, colorless, muriform, 18 to 22  $\mu$  long, 9  $\mu$  thick, mostly with 5 transverse septa and 3 faint ones in the long spore axis, the end cells irregularly



about 3-septate; ascus membrane staining a pale vinous red with iodine, the spores rich yellow, the other thecial structures blue.

On *Platanus* and *Heteromeles* in the Santa Monica Mountains and on oak bark on Santa Catalina Island.

### GRAPHIDACEAE.

Thallus crustaceous, attached to the substrate by medullary hyphæ; gonidia consisting of *Palmella* or *Chroolepus*; apothecia normally elongated, not combined in a stroma, with a proper margin; disk rimæform; paraphyses simple, branched or unbranched, generally distinct.

Only one genus as yet found within our limits.

### OPEGRAPHA Humb.

Apothecia with a proper margin, innate, appressed or sessile, mostly elongate, lirellæform; disk rimæform or slightly dilated; hypothecium dark or pallid; paraphyses branched and intertwining; asci clavate or oblong; spores in 8's, ovoid, oblong to fusiform, colorless, parallel-plurilocular with cylindric cells; sterigma simple; spermatia oblong, straight or curved.

Our species belong to the section *Euopegrapha* Muell. Arg., the margin brittle, carbonaceous, continuous with the hypothecium (as seen on a transverse section of an apothecium).

#### KEY TO SPECIES.

- Substratum rock; thallus white..... 1. *O. chevallieri*.  
 Substratum bark.  
   Spores 4 or 5-locular.  
     Apothecia small.  
       Straight or curved ..... 9. *O. umbellulariae*.  
       Ovate..... 2. *O. atra lichenoides*.  
     Apothecia larger.  
       Oblong ..... 3. *O. prosiliens*.  
       Linear, straight ..... 4. *O. atrorimalis*.  
   Spores 6-locular.  
     Apothecia small.  
       Round to ellipsoid..... 5. *O. pulicaris*.  
       Numerous, round to oblong and linear..... 8. *O. vulgata*.  
     Apothecia larger.  
       Linear-elongate ..... 6. *O. rimalis*.  
       Fusiform, acute, black..... 7. *O. diaphora*.

#### 1. *Opegrapha chevallieri* (Leight.).

*Opegrapha saxicola chevallieri* Leight. Lichenfl. Brit. ed. 3. 402. 1879.

Thallus white, furfuraceous, moderately thick, continuous to finely rimose, bordered by a thin black line, KHO—, Ca(CIO)<sub>2</sub>+red; apothecia black, straight or curved, flexuose, mostly crowded and even contiguous; epithecium rimæform or slightly dilated and then flat, black, under the microscope brown black, less dark than the hypothecium; thecium 80  $\mu$  high, dingy white, with iodine stained a deep orange; spores in 8's, ellipsoid, 12 to 14  $\mu$  long by 3.5 to 4  $\mu$  thick.

Newport Bluffs on sandstone; Santa Catalina Island on argillaceous rock.

#### 2. *Opegrapha atra lichenoides* Pers.

Only the forma *chlorina* Jatta represented in our area.

Thallus pale, dingy yellowish greenish, smooth; apothecia small, ovate to roundish, the proper margin finally nearly obsolete and the disk greenish-pruinose; epithecium granulose, greenish brown to dark brown; thecium 88 to 90  $\mu$  high, colorless, with iodine



dark orange; paraphyses interwoven; hypothecium reddish brown; asci clavate to oblong-ellipsoid; spores in 8's, fusiform, colorless, 24 to 28  $\mu$  long, 6 to 7  $\mu$  thick, 5-locular; after application of KHO surrounded by a halo.

On *Umbellularia californica*, Malibu Canyon, Santa Monica Mountains.

**3. Opegrapha prosiliens** Stirton.

Thallus thin, sordid pale yellowish gray, in small oval patches; hypothallus indistinct; epithecium subcontinuous, a narrow black border; thecium colorless, 80  $\mu$  high; hypothecium pale brown to brown; paraphyses branching, loosely interwoven; asci clavate, 72  $\mu$  long, 20  $\mu$  thick; spores in 8's, ellipsoid with a broad, distinct halo, 20 to 26  $\mu$  long, 6 to 7  $\mu$  thick, 4-locular, the two end cells smaller than the two central; with iodine the thecium and asci staining yellow, the epithecium and hypothecium dark brown.

On dead *Lycium californicum* near Newport, Orange County.

**4. Opegrapha atrorimalis** Nyl.

Thallus sordid pale yellowish, determinate by a thin blackish hypothalline border; apothecia sessile, simple, straight, linear; thecium rimæform; epithecium granulose, pallid, yellowish gray to brown; thecium pallid, 64 to 80  $\mu$  high; paraphyses laxly coherent; hypothecium brown to blackening; asci inflated-clavate, 44 to 60  $\mu$  long, 16 to 22  $\mu$  thick, the membrane slightly thickened above; spores bluntly fusiform or oblong-ovoid, 20 to 24  $\mu$  long, 6 to 9  $\mu$  thick, with a thin halo, 4-locular; hymenial gelatine with iodine brownish yellow.

On various smooth barks in the Santa Monica Range.

**5. Opegrapha pulicaris** (Hoffm.) Nyl.

Thallus whitish to dirty white; apothecia small, ovoid to ovoid-ellipsoid, simple; disk slightly dilated; epithecium granulose, sordid whitish; thecium 60 to 64  $\mu$  high, pallid; asci cylindric, about 60  $\mu$  long by 14  $\mu$  thick; spores fusiform, 24 to 28  $\mu$  long, 4 to 5  $\mu$  thick, 6-locular; hymenial gelatine with iodine pale yellowish red.

Santa Catalina Island on bark of *Rhus integrifolia*, and frequent in the Santa Monica Range on various barks.

**6. Opegrapha rimalis** Pers.

Thallus thin, sordid whitish, indeterminate; apothecia linear-elongate, small; epithecium sordid yellowish; thecium dingy white, 88  $\mu$  high; hypothecium dark brownish black; hymenial gelatine with iodine vinous red; spores fusiform, 20 to 28  $\mu$  long, 5 to 6  $\mu$  thick, 6-locular.

On various barks on Santa Catalina Island and the mainland.

**7. Opegrapha diaphora** Ach.

Thallus pale ash-colored, furfuraceous, epiphloeodal, continuous or becoming rimose; apothecia black, fusiform and acutish, the proper margin narrow, shining, some with a spurious thalline margin; disk flat, black; epithecium thin, yellowish black, paler than the hypothecium, gradually paling downward; thecium 92 to 96  $\mu$  high, colorless, staining with iodine orange to vinous red, the stain darkest in the lower part, the epithecium assuming a violaceous tint; paraphyses coherent and interwoven; hypothecium dark yellowish black; asci clavate, nearly equaling the thecium; spores 8, fusiform, 20 to 24  $\mu$  long, 5 to 6  $\mu$  thick; spermogones indicated by minute black dots; spermatia short, rod-shaped, slightly curved, 3 to 4  $\mu$  long, 1 to 1.5  $\mu$  thick.

On exposed roots of *Rhus integrifolia*, beach bluffs at White Point, near San Pedro.

**8. Opegrapha vulgata** Ach.

Thallus creamy white, effuse; apothecia numerous, small, roundish to oblong, linear, simple; epithecium rimæform; thecium colorless or pale yellow, 80 to 82  $\mu$  high; paraphyses branched and loosely interwoven; hypothecium deep brown black; asci subcylindric, 44 to 50  $\mu$  long, 14 to 18  $\mu$  thick; spores narrowly fusiform, 6-locular



the loculi equal, 16 to 24  $\mu$  long, 3.5 to 4  $\mu$  thick; hymenial gelatine with iodine reddish orange to a rich red brown.

Bark, Santa Catalina Island, *Trask*; on *Lycium californicum*, near Newport, Orange County; on bark of *Quercus agrifolia*, in the Santa Monica Range.

**9. Opegrapha umbellulariae** Zahlbr. Beih. Bot. Centralbl. **13**: 154. 1902.

Thallus whitish, smooth, continuous to delicately rimose, forming small roundish, epiphloeodal patches; apothecia small, black, straight or curved, simple or at times forked, linear-ellipsoid; disk rimæform to slightly dilated; epithecium black, carbonaceous; thecium 74  $\mu$  high; hypothecium pallid; hymenial gelatine with iodine blue soon changing to yellow and orange; spores in 8's, colorless, oblong, the ends blunt, 13 to 15  $\mu$  long by 4  $\mu$  thick, 4-locular, slightly constricted at points of septation.

On *Umbellularia californica*. Type locality, Malibu Canyon, Santa Monica Mountains.

Type deposited with Dr. A. Zahlbruckner; duplicate in herb. Hasse.

### CHIODECTONACEAE.

Thallus crustaceous, uniform, attached to the substrate by hypothalline or medullary hyphae, ecorticate (in our genera), with Chroolepus gonidia; apothecia in stromata, mostly immersed, orbicular or elongate, with a dark or colorless proper margin; paraphyses simple, free or branched and reticulate; spores parallel-multilocular, the loculi cylindric (in our genera); spermatia cylindric, elongated to elliptic, straight or curved.

#### KEY TO GENERA.

- Spores colorless..... CHIODECTON (p. 26).  
 Spores dark..... SCLEROPHYTON (p. 27).

### CHIODECTON Ach.

Apothecia variously shaped, from round and oblong to linear and stellate; proper exciple well developed, brittle, dark or rudimentary; hypothecium similar to the exciple; paraphyses branching, interwoven; spores fusiform to acicular or oblong, colorless, parallel-multilocular.

**1. Chiodecton ochroleucum** Zahlbr. Bull. Torrey Club **27**: 646. 1900.

"Thallus tenuis, effusus, inaequalis vel subrugulosus, tartareus, ochroleucus, KHO flavens, Ca(ClO)<sub>2</sub> erythrinus, medulla alba. I vinosa fulvescenti. Gonidia chroolepoidea, cellulis ellipsoideis vel oblongis, concatenatis. Pocadostromata thallo immersa vel rarius demum modica prominale, irregulariter oblonga, usque 1 mm. vel parum ultra longa, niveo-pruinosa. Hymenia stellata, substellata, elongata, vel plus minus flexuosa, apicibus obtusis, humectata mollia et turgescientia, ochracea, margine diaphana, intus pallida, I vinosa-rubescientia. Hypothecium et epithecium pallidum (lutescens). Paraphyses tenues, filiformes, connexo-ramosae. Asci ovali-cuneati, 8-spori, 53-62  $\mu$  longi et 20-22  $\mu$  lati. Sporae ovaes vel ovali-oblongae, hyalinae, transversim 4-5 septatae, cellulis cylindricis, 14-18  $\mu$  longi et 8  $\mu$  latae, episporio tenui. Receptacula pycnoconidiorum punctiformia, nigra, nitida, immersa, excepto vertice; sterigmatibus basi ramosis, cellulis superioribus subinflatis, longioribus, subfasciculatis; pycnoconidiis filiformibus, arcuatis, 11-18  $\mu$  in diam. et 1.5-1.8  $\mu$  latis."

"Species distincta, a *Chiodectone californica* Tuck. hymenio pallido et sporis minoribus latioribusque distat."

On bark of *Rhus integrifolia*, Santa Catalina Island, *Trask*.



**SCLEROPHYTON** Eschw.

Differs from the genus *Chiodecton* only in having dark spores.

**1. Sclerophyton californicum** (Tuck.).

*Chiodecton californicum* Tuck. Syn. N. Amer. Lich. **2**: 135. 1888.

Thallus "pale ochroleucous," thickly crustaceous, darkening with age; apothecia numerous, crowded, the thecial structure composed of a stroma of several apothecia surrounded by a turgid, persistent, thalline margin; disk dull black but densely pruinose and thus concolorous with the thallus, from round to angular and variously difform; thallus at the circumference inclining to become lobular and limited by a dull black hypothalline border; with KHO—,  $\text{Ca}(\text{ClO})_2$ +red, the medulla—; epithecium subgranulose and but little darker than the thecium; thecium  $140\ \mu$  high, pale sordid yellow giving no reaction with iodine; paraphyses interwoven, slender; hypothecium dark brown; asci clavate, thick-walled; spores in 8's, oblong-ellipsoid with blunted ends, brown, 6 to 8-locular, the cells cylindric, the spores 20 to  $30\ \mu$  long and 5 to  $7\ \mu$  thick.

Near Newport on *Lycium californicum* and on shrubs near San Diego at Point Loma; Santa Catalina Island at the "isthmus" on *Rhus integrifolia*.

**DIRINACEAE.**

Thallus crustaceous, uniform, attached to the substrate by hyphæ of the medullary layer; gonidia Chroolepus. Apothecia round or elongated with a proper and a thalline margin; hypothecium dark; spores parallel several-locular.

**DIRINA** Fries.

Paraphyses simple, unbranched; asci 8-spored, colorless, oblong or fusiform; spermatogones immersed; spermatia arcuate.

The only genus representing the family in our district. Our species growing on bark.

**KEY TO SPECIES.**

- |   |                         |
|---|-------------------------|
| Hymenial gelatine with iodine yellow.....     | 1. <i>D. hassei</i> .   |
| Hymenial gelatine with iodine vinous red..... | 2. <i>D. rediunta</i> . |

**1. Dirina hassei** Zahlbr. Bull. Torrey Club **27**: 644. 1900.

Thallus effuse, crustaceous, furfuraceous, finely rugulose, pale creamy whitish; apothecia small, numerous, sessile; disk planoconvex, dark, thickly pruinose, with an entire, thin, persistent thalline margin; epithecium light yellowish, granulose; thecium colorless, 76 to  $80\ \mu$  high, staining with iodine a rich yellow; paraphyses thin, entire, coherent; hypothecium brown; asci oblanceolate or subsaccate, 60 to  $64\ \mu$  long, 10 to  $12\ \mu$  thick; spores fusiform, colorless, slightly curved, obtuse, 4-locular, 16 to  $20\ \mu$  long, 4 to  $5\ \mu$  thick.

On bark of *Rhus laurina*. Type locality, beach near Santa Monica. The species occurs also on Santa Catalina Island on the bark of *Heteromeles arbutifolia*.

Type deposited with Dr. A. Zahlbruckner; duplicate in herb. Hasse.

**2. Dirina rediunta** (Stizenb.) Zahlbr. in litt.

*Lecanora rediunta* Stizenb.; Hasse, Bull. Torrey Club **24**: 446. 1897.

Thallus crustaceous, whitish to cream colored, effuse, smooth, continuous to finely rimose, epiphloeodal, KHO+ light yellow,  $\text{Ca}(\text{ClO})_2$ —; apothecia sessile, dispersed or at times crowded, small, 0.5 mm. wide; disk black, planoconvex, thickly white-pruinose with a thin, persistent, entire thalline margin; epithecium granulose, dark; thecium pale yellowish, 96 to  $112\ \mu$  high, with iodine vinous red; paraphyses coherent; asci clavate, 64 to  $68\ \mu$  long by  $10\ \mu$  thick; spores fusiform, colorless, straight or lightly curved, blunt, 20 to  $26\ \mu$  long, 4 to  $6\ \mu$  thick, 4 to 11-locular.



Type locality, Santa Catalina Island. On *Heteromeles arbutifolia*; also on bark of *Juglans californica* and other barks in the Santa Monica Mountains.

Type deposited with Dr. A. Zahlbruckner; duplicate in herb. Hasse.

### ROCCELLACEAE.

Thallus fruticulose, erect, attached by a basal disk; cortical and medullary layers distinct, with *Chroolepus* gonidia; apothecia round, lirellæform, or deeply lobed, innate or sessile.

#### KEY TO GENERA.

Cortical hyphæ parallel to thalline surface; apothecia round. *DENDROGRAPHA* (p. 28).  
Cortical hyphæ vertical to thalline surface.

Apothecia round..... *ROCCELLA* (p. 28).

Apothecia deeply lobed; spores dark..... *SCHIZOPELTE* (p. 29).

### *DENDROGRAPHA* Darbish.

Differing from *Roccella* only in the fact that the cortical hyphæ are parallel with the thalline surface instead of vertical to it.

#### KEY TO SPECIES.

Main trunks compressed, stout..... 1. *D. leucophaea*.

Main trunks not compressed, slender..... 2. *D. minor*.

#### 1. *Dendrographa leucophaea* (Tuck.) Darbish.

Thallus fruticulose, erect, densely branching, the main trunks compressed, the branches and branchlets terete, smooth, becoming finely attenuate, light yellowish gray and darkening to dull brown gray; apothecia numerous, mostly on the lower compressed portion of the thallus, sessile or subpedicellate, the disk circular, convex, dark, thickly pruinose, the thalline margin entire, persistent; epithecium pale yellowish gray, granulose; thecium colorless, 130 to 140  $\mu$  high, stained yellow with iodine; paraphyses loose, branched and forked below the tips, interwoven, the scarcely thickened apices not colored; hypothecium dark brown black, thick; asci sub-~~sub~~ flattened-clavate, the membrane thick, not colored by iodine but the contents yellow; spores fusiform-ellipsoid with blunt ends, straight or lightly curved, colorless, 20 to 27  $\mu$  long, 5 to 7  $\mu$  thick, 4-locular; spermogones numerous, sterigma straight, entire, forked, with acicular, hook-shaped or curved spermatia 12 to 16  $\mu$  long.

Santa Catalina Island, *Trask*; on *Lycium californicum* near San Pedro; Newport; on *Pinus torreyana* at Del Mar, near San Diego; Lower California.

#### 2. *Dendrographa minor* (Tuck.) Darbish.

Thallus fruticulose, slender, intricately branched, the basal disk rudimentary, the small trunk little if at all compressed, about 3 to 4 cm. high; soredia frequent but apothecia thus far not found.

On maritime rocks, rarely on shrubs, at San Francisco, *Herre*, and San Diego, *Orcutt*; frequent at Newport on rocks and occasional on shrubs; on rocks on Santa Catalina Island, and doubtless at other stations along the coast.

### *ROCCELLA* Lam. & DC.

Thallus fruticulose, erect, loosely branching, compressed or subterete; hyphæ of cortex vertical to thalline surface, with *Chroolepus* gonidia; basal disk corticate or ecorticate; soredia frequent; apothecia lateral, sessile, round with a black or decolorate proper margin and encircled by a thalline one; hypothecium black; paraphyses branching; asci 8-spored; spores colorless, oblong-fusiform, parallel 4-locular; spermatia staff-shaped, arcuate.



## KEY TO SPECIES.

Growing on rock.

Thallus compressed..... 1. *R. fuciformis*.

Thallus terete..... 3. *R. tinctoria*.

Growing on bushes..... 2. *R. fucoides*.

**1. *Roccella fuciformis* (L.) Lam. & DC.**

Thallus erect, fruticulose, dull whitish or grayish, glaucescent, compressed, sparingly dichotomously divided below into long-attenuate, flattish, narrow, ribbon-like segments, KHO—,  $\text{Ca}(\text{ClO})_2$ +red, 5 to 10 cm. high; apothecia sessile, flat, pruinose, of the same color as the thallus, marginal and lateral with a persistent, entire or finely crenulate thalline margin, this finally becoming flexuose, the disk now and then almost difform and denuded, dark and roughened; epithecium granulose, yellowish gray, gradually paling downward; thecium colorless, 100 to 136  $\mu$  high, with iodine pale yellow; paraphyses slender, branching; hypothecium black brown; asci clavate and subinflated-clavate, membrane thick, 76  $\mu$  high, 18  $\mu$  thick; spores colorless, straight or lightly curved, 4-locular, 20 to 28  $\mu$  long by 5 to 7  $\mu$  thick; spermatia acicular, arcuate and hook-shaped.

On rocks, Santa Catalina Island, *Trask*; Point Loma near San Diego, on shrubs. North and South America, East Africa, Asia Minor, and Europe.

**2. *Roccella fucoides* (Dicks.) Wain.**

"Thallus coriaceous, terete-compressed, dwarfish, dichotomously at length much branched, whitish ash colored, often sorediferous; spores 12 to 16  $\mu$  by 3 to 4  $\mu$ ."

A plant thus described is reported from San Diego (Tuck.) "growing on bushes, etc."

**3. *Roccella tinctoria* (L.) Lam. & DC.**

"Thallus coriaceous, terete, but often more or less flattened and pale, dull; sparingly branched but much elongated and intertangled; apothecia middling to ample, sessile, disk flattish, black, equaling or excluding the margin. Spores fusiform-oblong, 20 to 26  $\mu$  by 5 to 8  $\mu$ ." (Tuckerman.)

Reported by Mr. C. R. Orcutt<sup>1</sup> from San Diego.

North and South America, Asia, Europe, and Africa.

**SCHIZOPELTE T. Fries.**

Thallus erect, forked, the branches terete; apothecia terminal; disk irregularly incised or parted; hypothecium black; paraphyses branching; spores fusiform, brown, 3-locular.

**1. *Schizopelte californica* T. Fries.**

Thallus whitish (becoming cream-colored in herb.), terete, erect, fruticulose from a fasciculate tuft, distantly branching or furcate above, finely furfuraceous, with cephalodia, from 3 to 7 cm. high, KHO—,  $\text{Ca}(\text{ClO})_2$ +red; apothecia terminal and lateral, subpedicellate, oblique, irregularly lobed to flexuose and deeply lobed and difform; disk dull black, thinly pruinose, flattish to concave; thalline margin persistent and here and there coarctate; epithecium dark brown black, subgranulose; thecium about 100  $\mu$  high, dingy yellow with iodine; asci oblong-cylindrical, 72  $\mu$  long, 18  $\mu$  thick; spores in 8's, longitudinally or diagonally disposed, 18 to 24  $\mu$  long, 5 to 7  $\mu$  thick, brown, oblong, 4 to 7-locular, the end cells a little larger than the others.

On San Clemente Island, *Trask*; on rocks, Santa Catalina Island.

**Suborder CYCLOCARPINEAE.**

Large subdivision presenting all thalline forms from the crustaceous to the foliose and fruticulose; likewise all algæ known to form symbiosis with fungal hyphæ represented, this an important systematic character; apothecia for the greater part open or

<sup>1</sup> Fl. South. & Low. Calif. 12. 1885.



discoid, sessile upon or immersed in the thallus and thalline warts, or occurring distinctly pedicellate; exciple (outer covering or margin) well developed, though wanting in a few genera; apothecium either *biatorine* (the exciple soft in texture and pallid in color), *lecideine* (the exciple dark, black, and brittle, horny, or carbonaceous), or *lecanorine* (the exciple surrounded by a margin having the characters of the thallus); hypothecium (a continuation of the proper margin beneath the thecium or hymenium) partaking of the character of the margins in the forms of apothecia mentioned; paraphyses simple or branched, free or reticulately connected, without or with septa, their tops often thickened and colored, or the paraphyses closely adglutinated by hymenial gelatine; asci permanent, 1 to many-spored; spores 1-celled (simple), or variously partitioned, bilocular, polari-bilocular (a form of the bilocular, with the loculi (cells) more or less separated, being situated mostly at the poles of the spore and connected by a central tube (isthmus), this, however, sometimes absent), or muriform-multilocular, colorless or brown; sterigma variously formed, endobasidial or exobasidial.

## KEY TO FAMILIES.

Spores bilocular or polarilocular, colorless or brown.

Spores colorless, polarilocular.

Thallus crustaceous, uniform or lobed at periphery..... **CALOPLACACEAE** (p. 110).

Thallus foliaceous or fruticulose..... **TELOSCHISTACEAE** (p. 116).

Spores brown, 2 to 4-locular or muriform.

Thallus crustaceous, uniform or lobate at periphery..... **BUELLIACEAE** (p. 118).

Thallus foliaceous or fruticose..... **PHYSICIACEAE** (p. 127).

Spores simple, several locular or muriform, rarely colored.

Thallus gelatinous when moist, homoömerous, the algæ blue green.

Gonidia Scytonema or Stigonema algæ..... **EPHEBACEAE** (p. 70).

Gonidia Nostoc algæ, apothecia discoid..... **COLLEMACEAE** (p. 71).

Gonidia Gloeocapsa algæ; apothecia urn-shaped or discoid..... **PYRENOPSISACEAE** (p. 68).

Thallus not gelatinous when moist.

Thallus terete, more or less erect or pendent.... **USNEACEAE** (p. 105).

Thallus not terete.

Thallus crustaceous, uniform or lobed.

Gonidia Protococcus..... **DIPLOSCHISTACEAE** (p. 33).

Gonidia Chroolepus or Phyllactidium algæ..... **LECANACTIDACEAE** (p. 31).

Gonidia bright yellow green Pleurococcus or Palmella algæ.

Asci 1 to 8-spored, seldom 16 or more spored; apothecial margin pale and soft or dark and brittle.

Apothecia with lecanorine margin.... **LECANORACEAE** (p. 85).

Apothecia not lecanorine.

Not sunken in thallus.

Sessile..... **LECIDEACEAE** (p. 34).

Pedicellate..... **CLADONIACEAE** (p. 57).

Sunken in thallus..... **PERTUSARIACEAE** (p. 84).

Asci many-spored; apothecia lecanorine,

biatorine, or lecideine..... **ACAROSPORACEAE** (p. 62).



Spores simple, etc.—Continued.

Thallus not gelatinous when moist—Continued.

Thallus squamulose or foliose.

Apothecia affixed by entire under surface.. **PELTIGERACEAE** (p. 82).

Apothecia sessile or pedicellate.

Apothecia pedicellate upon podetia..... **CLADONIACEAE** (p. 57).

Apothecia not on podetia.

Medullary hyphæ absent or obsoles-

cent; algæ *Scytonema*..... **HEPPIACEAE** (p. 75).

Medullary hyphæ present.

Spores fusiform, several-locular;

thallus with cyphels..... **STICTACEAE** (p. 82).

Spores ovoid to ellipsoid, simple,

rarely bilocular.

Gonidia *Scytonema* algæ..... **PANNARIACEAE** (p. 79).

Gonidia *Pleurococcus* or *Parmella*  
algæ.

Apothecia lecanorine; thallus

foliaceous..... **PARMELIACEAE** (p. 99).

Apothecia not lecanorine, most-

ly lirellate; thallus mostly

monophyllous..... **GYROPHORACEAE** (p. 59).

### LECANACTIDACEAE.

Thallus crustaceous, uniform, with *Chroolepus* gonidia; apothecia circular, sessile or innate, having a distinct or rudimentary proper margin, naked; paraphyses branching and more or less reticulate; spores several-locular, colorless, with cylindrical loculi and a thin spore membrane; spermatia exobasidial.

#### KEY TO GENERA.

Proper margin wanting or rudimentary; apothecia naked,

with a lecanorine margin ..... **SCHISMATOMMA** (p. 32).

Proper margin well developed, black, carbonaceous, con-

tinuous with the hypothecium..... **LECANACTIS** (p. 31).

#### LECANACTIS Eschw.

Thallus crustaceous, uniform, attached to the substrate by the hypothalline or medullary hyphæ, ecorticate, without rhizinae; gonidia *Chroolepus*; apothecia innate, adnate, or sessile, circular, lecideine, with a carbonaceous proper margin, the lecanorine margin absent; hypothecium black, carbonaceous, continuous with the proper margin; paraphyses loose, branching, loosely interwoven; asci 4 to 8-spored; spores colorless, oblong, fusiform to acicular, parallel-bilocular to multilocular, the loculi cylindric; spermatia oblong to cylindric.

#### KEY TO SPECIES.

Apothecia circular, densely pruinose..... 1. *L. salicina*.

Apothecia often oblong or irregular, less densely pruinose..... 2. *L. californica*.

#### 1. *Lecanactis salicina* Zahlbr.; Hasse, Bryologist 11: 7. 1906.

Thallus, thin, effuse, finely scaly-furfuraceous, silvery gray with at times a faint yellowish tinge, KHO—, Ca(ClO)<sub>2</sub>—; epithecium fine-granulose, pale yellowish gray; thecium colorless, 70 to 72  $\mu$  high, staining yellow with iodine; paraphyses lax, loosely branching and interwoven; hypothecium dark brown black; asci clavate, nearly equaling the thecium in height; spores in 8's, colorless, fusiform, straight or lightly



curved 4-locular, 28 to 36  $\mu$  long, 4 to 6  $\mu$  thick, one end long-attenuate, the two end cells longer than the two central; apothecia sessile, round, from 0.3 to 0.5 mm. wide, the flat, densely white-pruinose disk surrounded by a thin, black, crenulate proper margin, markedly contrasting with the pruinose disk when moistened, the pruina disappearing later and the disk then black and planoconvex.

Type on *Salix lasiolepis*, Rustic Canyon in the Santa Monica Mountains.

Type deposited with Dr. A. Zahlbruckner; duplicate in herb. Hasse.

## 2. *Lecanactis californica* Tuck.

Thallus whitish cream-colored, furfuraceous, minutely areolate to verrucose; determinate, with a black hypothalline border, KHO+ light yellow, Ca(ClO)<sub>2</sub>—; apothecia sessile, round to angular or oblong and (rarely) even to broadly lirellate; disk flat to convex, whitish pruinose or epruinose and black, the persistent proper margin black, crenulate, carbonaceous; epithecium subcontinuous, yellowish brown; thecium colorless, 74 to 80  $\mu$  high; paraphyses loose, some forked once or twice below the clavate-thickened grayish apices; hypothecium dark brown black, carbonaceous; asci clavate, extending upward to the colored epithecium; spores colorless, in 8's, 24 to 28  $\mu$  long, 5 to 6  $\mu$  thick, fusiform, blunt-ended, 4-locular, straight or mostly a little curved; with iodine the epithecium and upper part of thecium reacting blue, the lower part with ascus membranes and spores a rich yellow.

Widely distributed over our district on various barks, but mostly found in proximity to the coast. Santa Catalina Island, Newport, Santa Monica Mountains, Del Mar, San Diego, etc.

## SCHISMATOMMA Flot. & Koerb.

Differing from *Lecanactis* in having a turgid lecanorine margin surrounding the apothecia, the spores also generally more narrowly fusiform; spermatia acicular, straight or curved.

### KEY TO SPECIES.

Growing on bark.

Spores 10 to 14-locular ..... 1. *S. pluriloculare*.

Spores 4-locular ..... 3. *S. californicum*.

Growing on rock ..... 2. *S. hypothallinum*.

1. *Schismatomma pluriloculare* Zahlbr. in Engl. & Prantl, Nat. Pflanzenfam. 1<sup>1\*</sup>: 116. 1907.

*Platygrapha plurilocularis* Zahlbr. Beih. Bot. Centralbl. 13: 156. 1902.

Thallus crustaceous, epiphloeodal sordid whitish, pulverulent, subverruculose, rimulose, limited by a black hypothalline border, KHO—, Ca(ClO)<sub>2</sub>+reddish; apothecia sessile, numerous and generally crowded, with a prominent, turgid, coarsely crenulate, now and then difform, lecanorine margin, giving the apothecia an urceolate appearance; disk flat, black; epithecium granulose, pale dingy yellow grayish to pale brown; thecium not quite colorless to pale brownish, 84 to 88  $\mu$  high, staining yellow with iodine; paraphyses coherent, interwoven, some forked above, not thickened or colored at the tips; hypothecium dark brown black; asci broadly ellipsoid, 88  $\mu$  long, 26  $\mu$  thick, the membrane somewhat gelatinous; spores in 6's or 8's, fusiform, colorless, 48 to 52  $\mu$  long, 4 to 6  $\mu$  thick, 10 to 14-locular, the loculi somewhat unequal, the spores straight or lightly curved; spermogones acicular, lightly curved, 16 to 20  $\mu$  long, less than 1  $\mu$  thick.

On *Rhus integrifolia*. Type locality, Santa Catalina Island. It has also been found on Santa Barbara Island by Mrs. Blanche Trask.

Type deposited with Dr. A. Zahlbruckner; duplicate in herb. Hasse.

## 2. *Schismatomma hypothallinum* (Zahlbr.).

*Platygrapha hypothallina* Zahlbr. Bull. Torrey Club 27: 645. 1900.

Thallus white, mealy, thick, effuse, convolute-rugulose, KHO—, Ca(ClO)<sub>2</sub>+ red; apothecia innate and sessile, round, often crowded and then irregularly round or



difform; disk flat to convex, white-pruinose, surrounded by a thick thalline margin; epithecium brownish, gradually paling downward; thecium pale sordid yellowish to brownish, 86 to 100  $\mu$  high, stained a dark red by iodine; paraphyses coherent and closely interwoven; hypothecium dark brown black; asci oblong, subcylindric, reaching to the colored epithecium; spores in 8's, fusiform, colorless, 24 to 30  $\mu$  long, 4 to 5  $\mu$  thick, with a gelatinous halo, 8-locular, the loculi equal in length.

Type from Santa Catalina Island on calcareous rock, *Trask*. San Clemente Island, same collector; on the mainland near Newport on sand rock.

Type deposited with Dr. A. Zahlbruckner, of Vienna; duplicates in the U. S. National Herbarium, with Dr. A. C. Herre, and in herb. Hasse.

### 3. *Schismatomma californicum* (Tuck.) Herre in litt.

*Dirina californica* Tuck. Lich. Calif. 17. 1866.

Thallus whitish ash-colored, rugose, effuse; apothecia sessile, crowded; disk black and thickly white-pruinose, surrounded by a turgid, wavy or crenulate thalline margin; epithecium granulose, pale to brownish; thecium colorless, stained blue by iodine; paraphyses closely coherent and intricate; hypothecium thick, dark brown black; asci clavate; spores dactyliform, 4-locular, 15 to 19  $\mu$  long, 3 to 4  $\mu$  thick.

Sparingly in the Santa Monica Mountains on *Quercus agrifolia*.

## DIPLOSCHISTACEAE.

Thallus crustaceous, uniform, subverruculose; apothecia round, immersed or appressed; disk generally small, concave to flat, surrounded by a proper and a lecanorine margin; paraphyses simple or forked above; asci 4 to 8-spored, the spores muriform, dark; gonidia recognised as *Protococcus*.

The family is represented with us only by one genus.

### DIPLOSCHISTES Norm.

#### KEY TO SPECIES.

Disk sessile, broadly concave, black.

Medulla with iodine blue..... 1. *D. scruposus*.

Medulla with iodine giving no reaction..... 2. *D. gypsaceus*.

Disk immersed, small, brown..... 3. *D. actinostomus*.

#### 1. *Diploschistes scruposus* (L.) Norm.

Characters as above. Thallus light gray to dark ash color, areolate-rimose and verruculose, the surface pulverulent, KHO—; Ca(ClO)<sub>2</sub>+red, the medulla also red, with iodine the medulla staining blue; apothecia innate, small to large (1.5 mm.); disk concave to flattish, dull black, more or less whitish pruinose, the proper margin darker than the disk, surrounded by a persistent thalline margin; epithecium brown; thecium colorless, 80 to 84  $\mu$  high; hypothecium sordid whitish, no reaction of the hymenial gelatine with iodine; spores brown, 4 to 8 in asci, muriform, oblong-ellipsoid, the transverse septa 5 or 6 with 1 to 3 fainter ones in the longitudinal spore axis; spore wall slightly contracted at points of septation, 28 to 36  $\mu$  long, 14 to 16  $\mu$  thick.

Cosmopolitan. Frequent throughout our territory. On earth or earth-covered rocks. Santa Cruz Mountains, *Herre*; San Diego, *Orcutt*; San Bernardino, *Parish*; Santa Monica Mountains; Santa Catalina Island.

The species is somewhat changeable according to the different hosts. In the variety *bryophilus* Ach. the thallus is whitish, thinner, and less rugulose. Over-running mosses and *Cladoniae*. In the variety *parasiticus* Sommerf., the thallus is obsolete or disappearing. In both varieties the apothecia are smaller than in the type. These forms occur occasionally in the Santa Monica range growing over *Cladonia pyxidata* and *C. tubaeformis*.



**2. *Diploschistes gypsaceus* (Ach.).***Urceolaria gypsacea* Ach. Lich. Univ. 338. 1810.

Thallus cretaceous white, pulverulent. Differs from *D. scruposus* in having somewhat larger spores and mainly in the absence of amyloid reaction of the medulla with iodine.

On dry sterile clay soil near Elsinore and on Santa Catalina Island.

**3. *Diploschistes actinostomus* (Pers.) Zahlbr. in Engl. & Prantl, Nat. Pflanzenfam. 1<sup>1\*</sup>: 122. 1907.***Verrucaria actinostoma* Pers.; Ach. Lich. Univ. 288. 1810.

Thallus indeterminate, areolate-rimose to diffract, light to dark ash gray, the areoles becoming verrucose, containing one to several apothecia, KHO—; with iodine the medulla blue; apothecia immersed, flattish to subglobose, small, the proper margin brown to darker, finely radiate-striate; epithecium continuous to subcontinuous, grayish brown; thecium colorless, about 140  $\mu$  high, staining yellow with iodine; paraphyses slender, intricate, not septate nor branched, slightly clavate at the apices; hypothecium colorless; asci cylindric; spores roundish and obovoid, light grayish blue becoming brown, muriform with 3 or 4 transverse septa and 1 or 2 in the long spore axis, 18 to 27  $\mu$  long, 10 to 18  $\mu$  thick.

On various rocks in the Santa Monica Mountains; Santa Cruz Peninsula, *Herre*.

**LECIDEACEAE.**

Thallus crustaceous, ranging from uniform to variously lobed, and to squamulose or rimose, rarely approaching the fruticose form; gonidia of the thallus bright green, belonging to the genus *Protococcus*; apothecia generally sessile, surrounded by a proper margin, this, like the hypothecium, pallid and waxy or dark (black) and horny, containing no gonidia, the thalline margin absent; asci containing from 1 to 8, rarely more, spores, these colorless or colored, entire or variously septate; spermatia ellipsoid or staff-shaped.

**KEY TO GENERA.**

Thallus crustaceous.

Paraphyses not branched, strict, coherent or distinct.

Spores simple, colorless..... LECIDEA (p. 34).

Spores compound.

Spores 2-celled (bilocular)..... CATILLARIA (p. 48).

Spores parallel 4 celled to pluricellular, thin-walled, the cells (loculi) cylindric..... BACIDIA (p. 50).

Paraphyses branched, lax; spores 2-celled or muriform-

multicellular, decolorate to dark ..... RHIZOCARPON (p. 55).

Thallus verrucose, squamulose, or microphylline..... TONINIA (p. 53).

**LECIDEA Ach.**

Thallus effigurate or uniform; apothecia circular or when crowded varying to angular, flexuose or even oblong, sessile or subsessile; proper margin and hypothecium from pallid and waxy to dark and horny; disk pale to black; paraphyses not branched; spores 8, rarely more, colorless, simple, globular, ovoid or oblong, thin-walled; spermatia staff-shaped or acicular, straight or curved.

**KEY TO SECTIONS.**

Thallus uniform.

Apothecial margin and hypothecium brittle, dark..... 1. EULECIDEA.

Apothecial margin and hypothecium not brittle, pale or dark... 2. BIATORA.

Thallus not uniform.

Squamulose to squamose, lobed more or less..... 3. PSORA.



## KEY TO SPECIES.

Section 1. **EULECIDEA** T. Fries.

Substratum bark.

- Thallus smooth, gray..... 20. *L. euphorea*.  
 Thallus not smooth, squamulose to whitish gray..... 15. *L. elabens*.

Substratum rock.

Thallus obsolete.

Proper margin (exciple) black.

- Sinuate; disk opaque, black..... 6. *L. diducens*.  
 Crenate; disk velvety black..... 9. *L. vorticosa*.

Proper margin (exciple) gray and fissured..... 7. *L. cinerata*.

Thallus present.

Thallus squamulose.

Squamules dark brown to black.

- Approximate..... 1. *L. atrobrunnea*.  
 Not approximate..... 4. *L. fumosa*.

Squamules lighter colored.

Light brown.

- Polished, bright chestnut brown.... 2. *L. protabacina*.  
 Not polished, light brown..... 3. *L. fuscatoatra*.

Not light brown.

Yellowish.

- Grayish yellow to fawn color.... 13. *L. atrolutescens*.  
 Pale ochroleucous, mealy..... 5. *L. hassei*.

Some shade of gray.

- Well developed..... 10. *L. platycarpa*.  
 Not well developed..... 11. *L. lithophila*.

Thallus not squamulose.

Thallus globular-verrucose.

Verrucæ whitish to grayish.

- Pale ash color..... 8. *L. lapicida*.  
 Whitish..... 18. *L. enteroleuca*.

Verrucæ pale yellow.

Thallus giving no reaction with

- KHO..... 12. *L. brandegei*.

Thallus with KHO+yellow.

Thalline verrucæ globular.

- Crenate or sublobulate..... 17. *L. catalinaria*.  
 Not crenate nor sublobulate. 18c. *L. enteroleuca pilularis*.

Thalline verrucæ flattened.

- Light gray..... 18b. *L. enteroleuca aequata*.

Not gray.

- Light yellow..... 16. *L. latypaea*.  
 Cream color..... 18a. *L. enteroleuca theioplaca*.

Thallus not globular-verrucose.

Granulose and disappearing, sordid within..... 19. *L. goniophila*.

Rimose-areolate, gray.

- Proper margin (exciple) conspicuous... 14. *L. plana*.  
 Proper margin (exciple) less conspicuous..... 21. *L. tessellata*.



Section 2. **BIATORA** T. Fries.

Substratum rock or earth.

Thallus not squamulose or only indistinctly so.

Pulverulent, light gray to sordid white, or obsolete. 29. *L. phaeophora*.Furfuraceous to indistinctly squamulose..... 32. *L. coarctata*.

Thallus squamulose.

Squamules small, not imbricate..... 35. *L. subplebeia*.

Squamules larger.

Peripheral squamules radiate..... 33. *L. granulosa phyllizans*.Peripheral squamules not radiating..... 22. *L. glebulosa*.

Substratum bark.

Thallus uniformly granulose, not becoming verruculose.

Light yellowish greenish..... 24. *L. querneae*.Dusky greenish gray..... 26. *L. viridescens*.

Thallus granulose to verruculose.

Thallus when present of some shade of brown.

Of an ordinary brown..... 34. *L. xanthococcoides*.Dull brown or deficient..... 30. *L. myriocarpoides*.

Thallus not brown.

Sordid white; apothecia brown black..... 31. *L. turgidula*.

Not white, gray of some shade.

Apothecia brown.

Light brown, flattened, grouped..... 23. *L. varians*.Rusty brown, not flattened..... 27. *L. vernalis*.

Apothecia blackening.

Dark brown to dull black..... 25. *L. fuscescens*.Black; margin (exciple) crenate to flexuose..... 28. *L. flexuosa*.Section 3. **PSORA** (Hall.) T. Fries.

Substratum wood or bark; thallus squamulose, the squam-

ules dusty brown or deficient..... 38. *L. friesii*.

Substratum mineral.

Substratum rock.

Squamules large, cervine brown, polished..... 41. *L. rubiformis*.

Squamules small.

Dark brown to black..... 42. *L. rufonigra*.Red brown..... 43. *L. scotopholis*.

Substratum earth.

Squamæ pink red..... 40. *L. crenata*.

Not pink, red brown to brown.

Apothecia minute, central on squamæ..... 37. *L. luridella*.

Apothecia large.

Situating near border of squamæ..... 39. *L. decipiens*.

Not near border of squamæ, central.

Apothecia globular..... 36. *L. globifera*.Apothecia not globular, flat..... 44. *L. lurida*.**1. Lecidea atrobrunnea** (Ramond) Schaer.

Thallus determinate, chestnut brown to darker, squamulose-areolate; squamules in our species mostly approximate or contiguous, lobulate or flexuose and concave to undulate and convex, glistening, the border blackening; apothecia sessile, the



disk flat or flattish-convex, black, with a thin, entire proper margin slightly paler than the disk; epithecium subgranulose; thecium colorless; paraphyses strict, coherent, some of them abruptly capitate above; hypothecium yellowish to brown; asci inflated-clavate, nearly as high as the thecium; spores in 8's, elongate-ellipsoid, 8 to 11  $\mu$  by 3 to 4  $\mu$ .

San Fernando Valley, Los Angeles County, at 300 meters altitude; Yosemite Valley at 2,000 meters; San Bernardino Mountains, Prospect Ridge near Seven Oaks, 2,300 meters; Tehachapi Mountains near Lone Pine Mine, at 1,350 meters; San Gabriel Canyon, Los Angeles County, at 1,350 meters.

**2. *Lecidea protabacina* Nyl.; Hasse, Bull. South. Calif. Acad. 2: 60. 1903.**

Thallus crustaceous, of reddish brown, approximate (mostly) or scattered, turgid, strongly convex, smooth, shining squamules, rounded, or angular by pressure, occasionally fissured and lobulate, darkening at the border and beneath, KHO—, Ca(ClO)<sub>2</sub>—; hypothallus black; apothecia sessile, single or several grouped, 0.5 to 2 mm. wide; disk black, smooth, glistening, slightly to strongly convex, the thin, smooth proper margin becoming gradually obscure; epithecium a thin, bluish black line; paraphyses strict, closely coherent; thecium 44 to 48  $\mu$  high, almost colorless at the center of the disk, dark at the circumference, and indistinguishable from the thick, dark brown hypothecium; hymenial gelatine stained blue with iodine; asci narrowly clavate; spores in 8's, oblong-ellipsoid, 11 to 12  $\mu$  by 4 to 5  $\mu$ .

A handsome lichen conspicuous by its chestnut brown patches from 3 to 6 cm. in diameter, on granite in the higher mountains. Type locality, Mount San Antonio, San Gabriel Range, at 3,300 meters; at the same elevation on Tauquitz Peak, San Jacinto Mountains; on San Bernardino Peak at 3,700 meters altitude.

Type deposited with Doctor Nylander; duplicates in the U. S. National Herbarium and in herb. Hasse.

**3. *Lecidea fuscatoatra* Nyl. sp. nov. in litt.**

Thallus crustaceous, determinate, of approximate, brown squamules, slightly concave to undulate and becoming convex, round-angular or lobulate, the hypothallus indistinct; KHO—, Ca(ClO)<sub>2</sub>—; apothecia subinnate or appressed, the disk dull black, flat to convex, round-angular or sinuate, the proper margin slightly lighter in color than the disk, thin, persistent, entire or crenulate and sinuate, subcarbonaceous; epithecium continuous, bluish black or brown black; thecium colorless, 90 to 92  $\mu$  high; paraphyses strict, coherent, not all clavate at the blunt, bluish tips; hypothecium brown, as dark as the epithecium and thicker than the thecium; hymenial gelatine blue with iodine, the stain extending into the hypothecium; asci clavate; spores in 8's, oblong linear ellipsoid, 8 to 12  $\mu$  long, 3 to 4  $\mu$  thick. Neither KHO nor NO<sub>5</sub> produces change in the colors of the thecial structures.

On granite rocks. Type locality, "Martin's Camp," San Gabriel Range, at 1,600 meters altitude. Has been collected in the Santa Cruz Mountains at 400 meters, *Herre*. Occurs at Camp Baldy, San Antonio Canyon, Los Angeles County, at 1,500 meters.

Type deposited with Doctor Nylander in 1898; duplicates in the U. S. National Herbarium and in herb. Hasse.

**4. *Lecidea fumosa* (Hoffm.) Ach.**

Thallus crustaceous, determinate, brown to blackish brown, squamulose; squamules small, flat, round, 0.5 to 0.75 mm. in diameter, scattered, to larger, approximate, and subimbricate, undulate and with a sinuate border; hypothallus distinct, black, giving to the naked eye an almost black surface to the lichen; apothecia appressed and sessile; disk black, flat, indistinctly pruinose or mostly naked, soon strongly convex, the thin black margin finally obscured; epithecium dark brown to bluish black, granulose, gradually paling downward; thecium colorless or pale bluish grayish, 68 to 70  $\mu$  high, staining blue with iodine; paraphyses strict, closely coherent, brown black at the apices; hypothecium dark brown; asci broadly ellipsoid and saccate,



about 50 to 60  $\mu$  long and 14 to 20  $\mu$  thick; spores in 8's, broadly ellipsoid, 8 to 16  $\mu$  long, 5 to 8  $\mu$  thick.

Frequent and of wide range both as to latitude and altitude.

On granite, San Gabriel Mountains, and on trap (Topanga Canyon at 160 meters altitude, Santa Monica Range); Santa Cruz Mountains near Mansfield at 70 meters and Black Mountain at 2,600 meters, *Herre*; Yosemite Valley at 1,600 meters; Matilija Canyon, Ventura County; Santa Catalina Island; San Fernando Valley; San Jacinto Mountains at 2,600 meters. North and South America, Africa, Asia, and Europe.

**5. *Lecidea hassei* Zahlbr. Ann. Mycol. 10: 374. 1912.**

"Thallus crustaceus, uniformis, epilithicus, ad 0.4 mm. crassus, subtartareus, effusus, areolato-diffractus, passim verruculoso-inaequalis, lutosocinerascens, opacus, KHO—,  $\text{Ca}(\text{ClO})^2$  dilute aurantiacus, in margine bene limitatus, sed linea obscuriore non cinctus, ecorticatus; medulla, alba, ex hyphis non amylaceis formata; gonidiis pleurococcoideis.

"Apothecia sessilia, dispersa vel conferta, usque 2 mm. lata, e rotundato anguloso-irregularia, sinuoso-incisa vel subgyrosa, nigra, primum urceolata, demum subplana; disco opaco, epruinoso; margine crassiusculo, bene prominulo, demum leviter depresso, nitidulo, ex integro flexuoso; perithecio ex hyphis radiantibus formato, extus nigro, intus pallidiore, crassiusculo, KHO—, J violaceocoeruleo; epithecio insperso nigro, KHO vix mutato (in fusum vergente),  $\text{NO}_5$ —; hymenio fere decolore, angusto, 45–55  $\mu$  alto, in hypothecium sensim abeunte, J e coeruleo lutescente; hypothecio crassiusculo, subcinnamomeo-cinerascente, KHO rosaceo, ex hyphis dense intricatis, ad superficiem disci plus minus perpendicularibus formato, J persistenter violaceocoeruleo; paraphysibus filiformibus, 1.5–1.8  $\mu$  crassis, conglutinatis, simplicibus, eseptatis, ad apicem capitato-clavatis; ascis hymenio subaequilongis, cylindrico-clavatis vel oblongo-clavatis, ad rotundatis et membrana modice incrassata cinctis, 8-sporis; sporis in ascis biserialibus, decoloribus, simplicibus, bacillari-oblongis, ad apices rotundatis, membrana tenuissima cinctis, 10–12  $\mu$  longis et 2–3.5  $\mu$  latis.

"Conceptacula pycnoconidiorum immersa, subglobosa, vertice nigro emergentia; fuleris exobasidialibus; pycnoconidiis bacillaribus, utrinque rotundato-retusis, rectis (rare suberectis), basidiis longioribus, 6–8  $\mu$  longis et ad 1  $\mu$  latis.

"Habituell sich der *Lecidea auriculata* Th. Fr. nähernd, gehört sie dennoch nicht in den Formenkreis dieser Spezies; eher wäre sie in der Gruppe der *Lecidea sarcogynoides* Koerb. einzureihen."

On sandstone at Ballona Bluffs near Santa Monica and Verdugo Mountains near Los Angeles.

**6. *Lecidea diducens* Nyl.**

Thallus obsolescent or quite obsolete; identical with *L. hassei* Zahlbr. in the varying characters and reactions of the apothecial structures and spores; irregularities of the proper margin often more marked than in the preceding species; at times a spurious thalline margin present, strongly fissured, simulating *Lecidea cinerata* Zahlbr. somewhat; in juvenile apothecia the margin coarctate; spores as in the last preceding species.

This is more frequent than *L. hassei* on rocks from lower levels to the summits of the higher ranges. Santa Monica Mountains, on trap and sandstone at 250 meters and lower; Tehachapi Mountains at 1,600 meters on granite; Del Mar on sandstone at 35 meters; Mount Wilson, San Gabriel Range, at 2,000 meters, on granite; in the Santa Cruz Mountains at 800 meters and higher, *Herre*.

**7. *Lecidea cinerata* Zahlbr. Bull. Torrey Club 27: 644. 1900.**

Thallus absent; apothecia more or less congregated, small, not over 1 mm. wide, round, angular, and sinuous, the margin prominent and coarctate; disk concave to flat, black, at first lightly pruinose; epithecium yellowish to blackish; thecium



colorless; paraphyses slender, entire, coherent, at the tips olivaceous brown; asci clavate; spores in 8's, colorless, simple, 12 to 14  $\mu$  long, 5 to 7  $\mu$  thick.

On disintegrated granite in the Santa Monica Range above Hollywood, the type locality. At Big Rock, the eastern base of the San Gabriel Range, at 1,600 meters.

Type deposited with Dr. A. Zahlbruckner; duplicate in herb. Hasse.

#### 8. *Lecidea lapicida* Fries.

Thallus medium thin, of a clear light ash color, finely rimose-areolate, the areolae slightly concave to flat, becoming lightly convex, or angulose and almost diffract, not stained with KHO; sterigmata short, straight, 6 to 8  $\mu$  long; apothecia dull black, innate, roundish to slightly angular; disk flat with a very thin, black proper margin, later becoming convex, pruinose, the margin sinuate and the disk lobed, the margin then obscure; epithecium bluish black or brown; thecium colorless, 80  $\mu$  high, with iodine blue turning sordid brown; paraphyses stout, subcoherent with abruptly capitate, brown or bluish black tips; hypothecium faint yellowish grayish; asci oblong clavate and subinflated clavate; spores in 8's, bluntly ellipsoid, 12 to 15  $\mu$  long, 6 to 7  $\mu$  thick.

On granite and other hard crystalline rocks, quite frequent, ascending from middle elevations; Santa Cruz Mountains, *Herre*; Topanga Canyon, Santa Monica Range, at 250 meters; San Antonio Canyon, San Gabriel Range, at 1,600 meters; Elsinore; Matilija Canyon, Ventura County; Tehachapi Mountains, at 1,800 meters. Throughout North America and Europe.

#### 9. *Lecidea vorticosa* (Floerke) Koerb.

Thallus in our district absent; apothecia sessile, the disk velvety black, from concave to flat and at last slightly convex, the proper margin persistent, black, crenulate; epithecium dark blue, subgranulose; thecium about 44  $\mu$  high, pale bluish gray, with iodine blue; paraphyses strict, coherent; hypothecium dark; spores in 8's, oblong, ellipsoid or almost linear, 8 to 11.5  $\mu$  long, 4 to 5  $\mu$  thick.

On disintegrated granite at Shoemakers Ranch, Big Rock Creek, 1,600 meters altitude, at the northeastern (desert) base of the San Gabriel Range.

#### 10. *Lecidea platycarpa* Ach.

Thallus crustaceous, thin, indeterminate, light gray, furfuraceous, indistinctly rimose, becoming obsolete; hypothallus indistinct; apothecia dispersed, small, 0.3 to 1 mm. wide, sessile, round; disk flat, with an entire or slightly crenulate, black proper margin, this almost disappearing as the disk becomes convex; hypothecium slightly horny, obscurely brown; epithecium brown, subcontinuous; thecium colorless; paraphyses strict, coherent, with clavate, bluish black tips; asci clavate; spores ellipsoid, 16 to 20  $\mu$  long, 7 to 10  $\mu$  thick.

On sandstone, Santa Cruz Mountains, *Herre*; Grand Canyon, Arizona. May be found in our limits.

#### 11. *Lecidea lithophila* (Ach.) T. Fries.

Thallus poorly developed, of small, thin, scattered, whitish to pale olivaceous squamules having a thin whitish pulverulent border; apothecia sessile, round, small, from 0.3 to 0.8 mm. wide; disk dull black, when moistened indistinctly brownish, flat to lightly convex, greenish pruinose, round with a thin, entire, black margin later becoming obsolete; epithecium continuous, brown; thecium colorless or faintly grayish tinted, with iodine blue, 80 to 92  $\mu$  high; paraphyses strict, subcoherent; hypothecium pale brown to almost colorless; asci inflated-clavate; spores rarely seen, ellipsoid, 9 to 15  $\mu$  long, 5 to 7  $\mu$  thick; with  $\text{NO}_5$  the epithecium becoming carmine red and purple.

On sandstone, Santa Cruz Mountains, *Herre*. A similar lichen is found in the southern part of the State, but being without spores can not be positively determined.



**12. *Lecidea brandegei* Tuck.**

Thallus crustaceous, pale dingy yellowish, determinate, rimose-areolate, the areolæ convex, round, oblong or angular, now and then lobate; hypothallus black, KHO—,  $\text{Ca}(\text{ClO})_2$ —; apothecia appressed, medium large (0.5 to 1.5 mm. wide), dull black; disk primarily flat with a semiturgid, prominent, dark grayish, entire or finely crenulate, now and then sinuate proper margin, later convex and the margin darker, becoming obscured; epithecium continuous, bluish black or grayish brown; thecium colorless, about  $76\ \mu$  high; paraphyses strict, moderately loosely coherent, clavate above, not septate nor branched; hypothecium light brown, paler than the epithecium; asci clavate; spores in 8's, rarely seen, ovoid-ellipsoid, 6 to  $9\ \mu$  long, 4 to  $5\ \mu$  thick; thecium stained deep blue with iodine.

On granite at Camp Baldy, at 1,500 meters altitude, in San Antonio Canyon, Los Angeles County; in Tahunga Canyon at a like elevation. "Rocky Mountains, Colorado," Brandege (Tuckerman).

**13. *Lecidea atrolutescens* Nyl.; Herre, Proc. Washington Acad. Sci. 12: 84. 1910.**

Thallus crustaceous, squamulose, light yellowish grayish to fawn color, imbricated or somewhat scattered, flat to lenticular, round or flexuose, naked or thinly whitish pruinose, the border whitish and crenulate, attached to the substrate by medullary hyphæ, KHO—,  $\text{Ca}(\text{ClO})_2$ —; hypothallus indistinct; apothecia sessile, scattered or crowded to conglomerate, 0.75 to 2 mm. wide; disk dull black, in age pruinose, with a raised, somewhat turgid, regular or mostly wavy margin, the disk becoming finally strongly convex and the persistent margin deeply sinuate; epithecium continuous, sordid dark grayish brown, gradually paling downward; thecium colorless to pale ash gray, 80 to  $84\ \mu$  high; paraphyses coherent, slightly clavate above and colored at the tips, not septate nor forked; hypothecium grayish yellowish, paler than the epithecium, much higher than the thecium; asci clavate and subinflated-clavate; spores in 8's, oblong-ellipsoid or ovoid-ellipsoid, 12 to  $16\ \mu$  long, 5 to  $8\ \mu$  thick; iodine staining epithecium, thecium, and hypothecium intensely blue; no changes with KHO; with  $\text{NO}_5$  the epithecium stained violet blue and in part obscurely a dark rose color; spermogones not seen.

On granite at Martins Camp, Mount Wilson, at 1,600 meters altitude (the type locality); at Camp Baldy, San Antonio Canyon, at 1,500 meters.

Type deposited with Doctor Nylander; duplicate in herb. Hasse. Collected at Grizzly Peak, Santa Cruz Mountains, by A. C. Herre.

**14. *Lecidea plana* Lahm.**

Thallus crustaceous, thin, finely rimose-areolate, often obsolete, gray, the hypothallus black, indistinct, KHO—,  $\text{Ca}(\text{ClO})_2$ —; apothecia small to medium-sized, adnate, variously angulose to round-lobed; disk concave to plane, black, often with a faint reddish tinge, the margin persistent, prominent; epithecium brownish; thecium 60 to  $67\ \mu$  high; paraphyses strict, simple, the separated apices brownish gray; asci narrowly clavate; hypothecium pale brownish; spores narrowly oblong-ellipsoid,  $11\ \mu$  long,  $3\ \mu$  thick; hymenial gelatine dark blue with iodine.

On Sandstone, Santa Monica Range, near the Soldiers' Home; on same substratum near Newport, Orange County. Not heretofore reported from North America. Norway, England, and Germany.

**15. *Lecidea elabens* Fries.**

Crust effuse, whitish or darkening to ash gray, granulose to areolate-rimose, the areolæ verrucose or minutely rugulose, KHO—,  $\text{Ca}(\text{ClO})_2$ —; apothecia numerous, crowded, 0.25 to 1.25 mm. in diameter, closely sessile; disk black, with a thin, entire, brownish black margin, later becoming convex to subglobose, somewhat rugulose, and the margin excluded; epithecium sooty brown, paling downward; thecium colorless to light reddish brown; paraphyses coherent; hypothecium pallid to color-



less; asci clavate, nearly equaling the thecium in height; spores linear-oblong, subfusiform, 8 to 13  $\mu$  long, 2 to 4  $\mu$  thick, diagonally or longitudinally disposed; thecium with iodine blue, the epithecium with  $\text{NO}_3$  reddish.

On dead pine wood, Tehachapi Mountains, at 1,600 meters altitude; bark of *Pseudotsuga macrocarpa* in the San Gabriel Mountains at a like elevation; dead wood and fence boards, Santa Cruz Mountains, at 1,000 meters, *Herre*. New England States; middle and northern Europe.

**16. *Lecidea latypaea* Ach.**

Thallus of pale, whitish or light ash-colored, small, round, semiglobular or flattish verrucæ, these scattered or congregated,  $\text{KHO}+$  yellowish,  $\text{Ca}(\text{ClO})_2-$ ; hypothallus absent; apothecia closely or somewhat deeply appressed, the disk black, mostly flat, round to irregularly angulose or lobulate, finally convex, the margin thin, concolorous or brownish or grayish black, not crenulate, but following the irregularity of the disk and finally obscured; epithecium continuous or subgranulose, bluish black to brownish; thecium colorless to grayish, about 80  $\mu$  high, stained intense blue with iodine, especially in upper part; paraphyses free to loosely coherent, the tips bluish black; hypothecium yellowish brown to brown, thick; with  $\text{KHO}$  the epithecium light brown, the hypothecium yellowish; asci clavate or subinflated clavate, 48 to 52  $\mu$  long, 20  $\mu$  thick; spores in 8's, broadly ellipsoid, often with one or two globules that disappear after  $\text{KHO}$ , 10 to 16  $\mu$  long, 5 to 12  $\mu$  thick; spermatia not seen ("arcuate, acicular").

Widely dispersed; on sandstone, Santa Monica Mountains; calcareous rock, Santa Catalina Island; Santa Cruz Mountains at Laguna Creek, *Herre*. Eastern and middle United States; Europe; northern Asia.

**17. *Lecidea catalinaria* Stizenb.; Hasse, Bull. Torrey Club 24: 447. 1897.**

*Lecidea catalinaria* Stizenb.; Hasse, Lich. South. Calif. 14. 1896, nomen nudum.

Thallus yellow, verruculose, the verrucæ distinctly separate, congregated or dispersed, round, smooth, or sometimes larger, then oblong and obscurely lobulate,  $\text{KHO}+$  yellow,  $\text{Ca}(\text{ClO})_2+$  red; hypothallus obscure; apothecia innate and adnate, round, often grouped and then angular; disk black, flat, then lightly convex, the margin at first prominent, then partly obscured; epithecium pale bluish or brown; thecium 60 to 80  $\mu$  high, colorless; paraphyses loosely coherent, not jointed nor forked, slightly capitate at the blue or brown apices; asci clavate, 54 to 76  $\mu$  high, 16 to 20  $\mu$  thick, the membrane thin, thickened above; hypothecium pale yellowish, in places almost colorless, with iodine permanently dark blue; spores in 8's, obovoid-ellipsoid and round-ellipsoid, the endospore and exospore distinct, 12 to 17  $\mu$  long, 6 to 9  $\mu$  thick, not affected by iodine.

Type locality near Avalon, Santa Catalina Island, on a sandstone boulder, and at the isthmus of the island on volcanic rock.

**18. *Lecidea enteroleuca* Ach.**

Thallus mostly minutely verruculose, the small whitish or pale sulphur-colored wartlets also often flattish or squamulose, scattered or congregated or almost disappearing,  $\text{KHO}+$  yellow,  $\text{Ca}(\text{ClO})_2-$ ; (occasionally this last reagent giving a red color of the thallus); hypothallus indistinct; apothecia subinnate to sessile, small, 0.25 to 1 mm. wide, dispersed or grouped; disk black, dull or partly shining, flat, the proper margin concolorous, entire, the disk later convex and the margin obscure or excluded; epithecium continuous or subcontinuous, bluish black; thecium colorless; paraphyses lax-coherent; hypothecium pallid or dark; asci inflated to saccate; spores simple, ovoid or broadly ellipsoid, 9 to 18  $\mu$  long, 6 to 10  $\mu$  thick; spermatia acicular, arcuate.

On rocks; frequent and widely distributed. Varying as to thallus and hypothallus, causing the creation of forms, of which the following are found in our territory.



**18a. *Lecidea enteroleuca theioplaca* Tuck.**

Thallus of minute pale yellow verrucæ, mostly congregated, a black hypothallus distinctly seen, KHO+ yellow, Ca(ClO)<sub>2</sub>+ light red; apothecia, etc., as in the species.

On slaty rock, Santa Monica Mountains.

**18b. *Lecidea enteroleuca aequata* (Floerke) Tuck.**

Thallus white or whitish ash-colored, irregularly and interruptedly rimose-areolate, KHO+ distinctly yellow, Ca(ClO)<sub>2</sub>—; epithecium bluish black, with KHO turning violet; hypothecium pale fuscous.

On calcareous rock, Santa Monica Mountains; on granite, Tehachapi Mountains at 1,700 meters altitude.

**18c. *Lecidea enteroleuca pilularis* (Davies?) T. Fries.**

Crust whitish and faintly ash-colored, verruculose and areolate-verruculose; apothecia adnate, small; disk flat with a thin, erect, black proper margin, later becoming convex and immarginate; epithecium subcontinuous, bluish; paraphyses loose; hypothecium pallid; asci clavate and inflated-clavate; spermatia arcuate.

Sandstone, Topanga Canyon, Santa Monica Mountains.

**19. *Lecidea goniophila* (Floerke) Schaer.**

Crust thin, granulose, ash-colored, often almost disappearing, KHO+ yellow, Ca(ClO)<sub>2</sub>+ pale red; apothecia adnate, small, 0.25 to 0.75 mm. wide; disk black, primarily somewhat concave, the proper margin suburgid with a dark brown dash, finally planoconvex and the margin obsolete; epithecium pale bluish gray; thecium 100  $\mu$  high, colorless; paraphyses slender, loosely coherent; asci oblong about 12 to 16  $\mu$  shorter than the thecium; spores in 8's, oblong, ovoid-ellipsoid, one end often abruptly attenuate 16 to 20  $\mu$  long, 7 to 9  $\mu$  thick; spermatia "straight," not seen in our specimen.

On sandstone, Fatijo Ranch, Santa Cruz Mountains, *Herre*; northern base of the San Gabriel Range, at Shoemakers Ranch, Big Rock Creek, 1,500 meters altitude. England and continental Europe.

**20. *Lecidea euphorea* (Floerke) Nyl.**

Thallus pale greenish grayish, effuse, smooth, epiphloeodal, KHO+ yellow, Ca(ClO)<sub>2</sub>—; apothecia sessile, dispersed, small, 0.25 to 0.8 mm. wide, light colored internally, the disk brownish black, at first plane with a concolorous, prominent margin, this becoming obsolete and the disk planoconvex; epithecium colorless; thecium colorless; paraphyses free, not thickened at the apices; hypothecium colorless or with a faint yellowish tint; asci ventricose; spores in 8's, broadly ellipsoid, 11 to 16  $\mu$  long, 6 to 8  $\mu$  thick; hymenial gelatine with iodine blue, soon yellowish brown; spermatia acicular, arcuate. (Determined by Doctor Nylander.)

On *Umbellularia californica*, in canyons of the San Gabriel Range, Los Angeles County; on the same bark in the Santa Cruz Peninsula, *Herre*. Europe. Not heretofore reported from North America.

**21. *Lecidea tessellata* Floerke.**

Crust pale gray, areolate-rimose, the areolæ flat or somewhat concave, angular, determinate, a dark hypothalline border observable, KHO—; apothecia numerous, crowded, in places contiguous, imbedded in or slightly raised above the thallus, dark, dull black, flat; faintly pruinose, the margin thin, subpersistent; paraphyses subcoherent, with bluish black apices, these with KHO changing to brown; thecium sordid, colorless, about 56  $\mu$  high; hypothecium faintly colored; asci subventricose; spores in 8's, 9 to 11  $\mu$  long, 5 to 6  $\mu$  thick.

On granite, San Jacinto Mountains at 2,300 meters altitude; in the Santa Cruz Mountains at altitudes varying from 170 to 1,000 meters, *Herre*.



**22. *Lecidea glebulosa* (J. E. Smith) Schaer.**

Crust thick, of whitish, convex squamules, crenate-lobulate and rugulose, furfuraceous, KHO+yellow,  $\text{Ca}(\text{ClO})_2$ +red (red reaction faint and tardy to appear in some specimens or altogether absent); apothecia sessile, often grouped and conglomerate; disk red brown, brown black, and dull black (as usually in the herbarium); disk at first flat, becoming convex and papillate, excluding the pale apothecial margin; epithecium continuous, reddish brown, gradually paling downward; thecium colorless, at least the lower part; paraphyses coherent, their tips clavate and slightly colored; hypothecium colorless; asci clavate or subinflated-clavate; spores oblong-ellipsoid, with blunt ends and one or several globules disappearing after KHO, 10 to 18  $\mu$  long, 4.5 to 7  $\mu$  thick; hymenial gelatine blue with iodine, no change by KHO.

On soft crumbling sandstone and earth in the Santa Monica Mountains; on earth at Point Loma near San Diego and at Eden Hot Springs, Riverside County; Santa Catalina Island.

**23. *Lecidea varians* Ach.**

Crust pale ash-colored, thin, granulose, circumscribed by a black hypothalline border, KHO+yellow,  $\text{Ca}(\text{ClO})_2$ —; apothecia separate or congregated and then appearing conglomerate, adnate, dull brown, when moistened semitranslucent, soon becoming planoconvex and the margin obsolete; epithecium colorless or pale yellowish; hypothecium colorless or with barely a shade of color; paraphyses adglutinated; pores ovoid, 7 to 12  $\mu$  long, 5 to 7  $\mu$  thick; hymenial gelatine with iodine blue gradually; changing to brown.

Frequent on various living barks in the Santa Monica Mountains. Common throughout North America.

**4. *Lecidea querneae* (Dicks.) Ach.**

Crust granulate-pulverulent, yellowish greenish, thin, effuse; apothecia subinnate, numerous, dispersed; disk convex, brown black to black, the margin becoming obsolete; epithecium subcontinuous, brown; thecium about 80  $\mu$  high, colorless to light brownish; paraphyses coherent; hypothecium of the same color as the thecium; asci clavate; spores in 8's, 10 to 12  $\mu$  long, 7 to 8  $\mu$  thick; hymenial gelatine with iodine blue.

On various barks, Santa Monica Mountains; on redwood fence boards near "Pigeon Point Lighthouse," Santa Cruz Peninsula, *Herre*. West coast of North America, Europe.

**25. *Lecidea fuscescens* Sommerf.**

Thallus of minute, flat, grayish scales forming an effigurate crust upon a conspicuous, black hypothallus; apothecia numerous, small, 0.3 to 0.5 mm. in diameter, sessile; disk dull brown black or black, circular, flat with a thin inconspicuous margin, becoming finally obscure with the disk slightly convex; epithecium subcontinuous, bluish gray; thecium 48  $\mu$  high; paraphyses coherent; hypothecium colorless; asci cuneate, 42  $\mu$  long, 10  $\mu$  thick; spores in 8's, ovoid-ellipsoid, 6 to 10  $\mu$  long, 4 to 7  $\mu$  thick.

On living bark of *Grossularia hesperia*, in canyons of the Santa Monica Mountains.

Although assigned by the authorities cited to an alpine and subalpine habitat, it is here reported from this "subtropical" climate, corresponding well with the descriptions of Tuckerman and T. Fries.

**26. *Lecidea viridescens* (Schrad.) Ach.**

Thallus dull grayish green and darkening, its irregularly globular granules mostly approximate, effuse; hypothallus indistinct, KHO+yellowish brown,  $\text{Ca}(\text{ClO})_2$ +reddish; apothecia adnate or closely sessile, small; disk flat or slightly convex, black, soon immarginate; thecium 60  $\mu$  high, pallid; paraphyses brown at the apices



(some of them); hypothecium pale; asci inflated-clavate,  $48\ \mu$  long,  $12\ \mu$  thick; spores ovoid-ellipsoid,  $10\ \mu$  long, 3 to  $5\ \mu$  thick.

Frequent on bark of *Pseudotsuga macrocarpa* in the San Gabriel Range from middle to higher elevations, but rare in fruit. Northern United States and Canada; northern Europe.

**27. *Lecidea vernalis* (L.) Ach.**

Crust pale ash color, continuous (smooth and pale yellowish gray on bark of *Umbellularia californica*), and often granular; apothecia sessile, small, 0.25 to 0.3 mm. in diameter, dispersed or often crowded and contiguous; disk flat, dull rusty brown, the margin somewhat lighter in color, finally becoming dark reddish brown, slightly convex and the margin disappearing; epithecium colorless or pale smoky; thecium  $76$  to  $80\ \mu$  high; paraphyses adglutinated; hypothecium pallid, of similar hue to the epithecium; asci clavate; spores in 8's, ellipsoid, 8 to  $16\ \mu$  long, 3 to  $4\ \mu$  thick, not rarely appearing falsely bilocular; hymenial gelatine with iodine blue, turning a sordid greenish blue.

On various barks (*Juglans californica* *Salix lasiolepis*, *Ceanothus divaricatus*), in canyons of the Santa Monica Mountains and on decorticated pine in the San Gabriel Range at 1,700 meters altitude; on decorticated oak in the Tehachapi Range near "Lone Pine Mine." The forma *minor* Nyl. occurs on *Umbellularia californica* in the Santa Monica Mountains. Eastern and northern part of the United States; northern Europe.

**28. *Lecidea flexuosa* (Fries) Nyl.**

Crust of pale greenish gray, minute, flattish-convex squamules, many with a sorediose appearance, for the most part closely congregated, KHO—,  $\text{Ca}(\text{ClO})_2$ +red; apothecia sessile, the disk persistent flat, black, slightly roughened, the permanent margin thin, black, more or less flexuose; epithecium pale; thecium nearly colorless to sordid pale brown; paraphyses adglutinated, indistinct; hypothecium pale; asci clavate; spores obovoid-ellipsoid, 8 to  $10\ \mu$  long, 3 to  $5\ \mu$  thick; hymenial gelatine with iodine yellowish.

On charred manzanita wood, Santa Monica Mountains; Tehachapi Mountains on dead wood; bark of conifers in the San Bernardino Mountains. Eastern and southern United States; Europe.

**29. *Lecidea phaeophora* Stizenb.; Hasse, Bull. Torrey Club 24: 448. 1897.**

Crust pulverulent, indeterminate, nearly obsolete, KHO+orange,  $\text{Ca}(\text{ClO})_2$ —; apothecia crowded, sessile, the disk reddish brown (when moistened light flesh-colored), planoconvex, the margin indistinct, with a pulverulent, spurious thalline margin; epithecium pale, continuous; thecium colorless,  $52\ \mu$  high; paraphyses lax, coherent, the scarcely thickened apices of similar color to the epithecium; hypothecium colorless; asci clavate and inflated-clavate, about equaling the thecium in height; spores in 8's, oblong-ellipsoid, simple, colorless, 8 to  $12\ \mu$  long, 4 to  $7\ \mu$  thick; spermogones not seen; hymenial gelatine with iodine a handsome blue, including the epithecium and hypothecium, with KHO the epithecium a pale violet.

On calcareous rock near Avalon, Santa Catalina Island, the type locality.

Type deposited with Doctor Stizenberger in 1896, the fate of the specimen unknown to the writer; duplicate in herb. Hasse.

**30. *Lecidea myriocarpoides* Nyl.**

Crust dull brown, granulate-squamulose, or deficient; apothecia sessile, small 0.2 to 0.5 mm. in diameter; disk flat or slightly convex, undulate and blackening; margin permanent, thin, of a slightly lighter shade than the disk; epithecium dark brown; thecium dirty white, about  $48\ \mu$  high; paraphyses adglutinated; hypothecium pale brown; asci clavate; spores broadly ellipsoid, 8 to  $9\ \mu$  long, 4 to  $5\ \mu$  thick; hymenial gelatine with iodine blue, soon becoming brown.



On a dead stump of *Platanus racemosa* in the Santa Monica Mountains; on denuded oak wood in the Tehachapi Mountains, at 1,500 meters altitude. Eastern and southern United States and northern Europe.

**31. *Lecidea turgidula* Fries.**

Thallus thin, sordid white, effuse, of small globules forming a here and there obsolete crust; apothecia sessile, scattered or grouped and conglomerate; disk blackish brown, turgid, convex, soon immarginate; epithecium not granulose, grayish, darker than the hypothecium; thecium and hypothecium also gray; paraphyses adglutinated (thecium about  $40\ \mu$  high, with iodine blue); asci clavate; spores in 8's, ellipsoid, 10 to  $12\ \mu$  long, 3 to  $5\ \mu$  thick.

On bark of *Pseudotsuga*, Yosemite Valley.

**32. *Lecidea coarctata* (J. E. Smith) Nyl.**

Crust whitish to ash-colored, furfuraceous-squamulose, areolate or the squamules scattered, KHO—,  $\text{Ca}(\text{ClO})_2$ —, our lichen differing in this want of reactions from the European form according to the authors cited; apothecia small, dispersed, innate or adnate, the disk papillate, flat to planoconvex, reddish brown to blackening, occasionally with a pulverulent, spurious thalline margin; epithecium yellowish, granulose; thecium about  $120\ \mu$  high, colorless; asci inflated-clavate or oblong-cylindric; spores ovoid, 20 to  $23\ \mu$  long, 11 to  $12\ \mu$  thick.

Frequent on earth or rocks. Throughout the United States; in Africa; tropical America and Europe.

It differs somewhat in the thallus and of the resulting forms described by authors we have: Forma *elachista* (Ach.) T. Fries, the thallus consisting of thinly scattered areoles—on earth, Los Gatos, *Herre*; and forma *obtegens* T. Fries, with the thallus thick, spreading, granulate-pulverulent, the disk red brown—on earth, Santa Monica Range.

**33. *Lecidea granulosa phyllizans* Zahlbr. Beih. Bot. Centralbl. 13: 159. 1902.**

"Thallus in margine lobatus, lobis subcartilagineis, rotundatis, incisis vel incisocrenatis, in centro plicato-verruculosus, cinerascens-albidus, subpulverulentus, KHO lutescens,  $\text{Ca}(\text{ClO})_2$  bene erythrinus, nunquam leproso-fatiscens. Apothecia primum plana, disco livido-vel ochraceo-fuscescente, demum nigricantia et immarginata. Conceptacula pycnoconidiorum copiosa, ubique in superficie thalli sita, punctiformia, globoso nigra, madefacta fuscescentia, semiimmersa; perithecio dimidiato; fulcris exobasidiis; basidiis anguste lageniformibus, dense congestis, subverticillatis vel verticillatis, pycnoconidiis bis vel ter longioribus; pycnoconidiis bacillariibus, medio hinc inde parum angustioribus vel uno apice leviter latioribus, rectis vel subrectis, apicibus obtusis, 7–9  $\mu$  longis et 1.2–1.5  $\mu$  latis.

"Ad terram inter muscos et *Cladonias* in declivibus occidentalibus montium San Gabriel, c. 1700 m. [Hasse no. 742]."

**34. *Lecidea xanthococcoides* Zahlbr. Bull. Torrey Club 27: 644. 1900.**

"Thallus tenuis, ruguloso-granulatus vel verrucosus, pallide cervino-fuscescens, KHO—,  $\text{Ca}(\text{ClO})_2$ —, non corticatus, hyphis non amyloideis. Gonidia protococcoidea, globosa, 10–18  $\mu$  diam. Apothecia parva (0.2–0.3 mm. lata), sessilis, nigra, opaca, primum modice concava vel plana, margine tenui, integro subnitidoque cincta, demum convexa et immarginata. Excipulum et hypothecium fuscum. Hypothecium obscure fuscum,  $\text{NO}_5$ —, KHO nubes fuscescentes effundens. Hymenium 160–180  $\mu$  altum. I coerulescens, dein obscure fulvescens. Paraphyses conglutinatae, tenues. Asci oblongo-vel ovoideo-cuneati, 8-spori. Sporae ovaes vel oblongo-ovales, obtusae, simplices, hyalinae, 12–15  $\mu$  longae et 5.5–6  $\mu$  latae, episporio tenui.

"Habita ad *Lecideam xanthococcam* accedit, sed structura interna apotheciorum ab ea longe distat. *Lecidea hypomelaenae* Nyl. affinis.

"Ad truncos Coniferarum in montibus San Bernardino, circa 1,700 mt. s. m."



**35. *Lecidea subplebeia* Nyl. sp. nov. in litt.**

Crust dull white, pulverulent, rimose-areolate, effuse,  $\text{KHO—}$ ,  $\text{Ca}(\text{ClO})_2\text{—}$ , no reaction of the medulla with iodine; thallus now and then slightly rugulose; apothecia closely adnate, small, 0.25 to 0.5 mm. in diameter, dispersed; disk black, slightly convex in the fully developed apothecia; proper margin thin, black, persistent; thecium 48 to 60  $\mu$  high; paraphyses coherent, septate, with small, globular, dark heads; hypothecium pale fuscous, not horny; asci clavate; spores in 8's, ovoid-ellipsoid, 9 to 12  $\mu$  long, 6 to 7  $\mu$  thick.

On adobe soil and small pebbles, foothills of the Santa Monica Range. Type locality above "Brown's Lake," near the Soldiers' Home.

Type deposited with Dr. W. Nylander in 1897; duplicates with Dr. A. Zahlbruckner and in herb. Hasse.

**36. *Lecidea globifera* Ach.**

Thallus squamulose, fawn color or red to greenish red, paling at the edges and beneath, more or less closely imbricated, ascending to erect, not over 1 mm. wide, entire or round-lobed; apothecia sessile, the disk globose, purplish black, papillate, emarginate; epithecium yellowish brown; paraphyses adglutinate, not sharply defined; thecium sordid brown; hypothecium brown, paler than the epithecium; asci clavate; spores in 8's, ovoid-ellipsoid, 8 to 13  $\mu$  long, 5 to 7  $\mu$  thick.

On earth, frequent and widely distributed. San Bernardino, *Parish*; foothills of the Santa Monica and San Gabriel ranges; Palm Springs and the adjoining Colorado Desert.

The squamules of the desert forms are of darker brown color and the surface is fissured to rugulose.

**37. *Lecidea luridella* (Tuck.).**

*Biatora luridella* Tuck. Gen. Lich. 156. 1872.

Thallus of small squamules (0.5 to 2 mm. wide), round or sinuate-lobed, loosely imbricated, brown red, white pruinose at the circumference and pale beneath, forming roundish patches from 2.5 to 4 cm. wide,  $\text{KHO—}$ ,  $\text{Ca}(\text{ClO})_2\text{—}$ ; apothecia sessile, minute, central, mostly solitary, 0.5 to 0.8 mm. in diameter, the disk planoconvex, dark brown, the margin obsolete; epithecium granulose, pale ocher color; paraphyses coherent; thecium 60 to 68  $\mu$  high; hypothecium paler than epithecium or colorless; asci inflated-clavate; spores in 8's, ellipsoid and oblong-ellipsoid, 8 to 12  $\mu$  long, 4 to 6  $\mu$  thick; hymenial gelatine stained pale blue with iodine.

On earth; Castle Rock Park, Santa Cruz Peninsula, *Herre*; frequent on open grassy foothills of the Santa Monica Range near the Soldiers' Home; grassy plains at Muriette Hot Springs, Riverside County; Santa Catalina Island.

**38. *Lecidea friesii* Ach.**

Thallus scantily represented, of approximate, not contiguous, minute, dark dun-colored glebæ; apothecia appressed, minute, black, convex and slightly roughened, internally dark, the margin obscure; epithecium continuous, brown; thecium sordid pale brownish, 98  $\mu$  high; spores in 8's, ellipsoid, 8 to 9  $\mu$  long, 3.5 to 4  $\mu$  thick; hymenial gelatine with iodine pale sordid blue.

On carbonized bark in Mill Creek Canyon, San Bernardino Mountains at 1,500 meters altitude. Northeastern United States; northern Europe.

**39. *Lecidea decipiens* (Ehrh.) Ach.**

Thallus of discrete or crowded squamules, rotundate or lobulate, concave, peltately affixed, brick red to brown, whitened at the periphery (in exposed situations, as in the desert, often fissured), flat or ascendant, 2 to 4 mm. in diameter; apothecia sessile, marginal, 0.25 to 1 mm. wide; disk planoconvex, brown black, papillate, the margin soon excluded, the disk finally globose and not seldom conglomerate; epithecium yellowish brown; paraphyses adglutinate; thecium pale and yellowish; hypothecium



similar in color to the epithecium; asci clavate and inflated-clavate; spores in 8's, ovoid-ellipsoid, 11 to 16  $\mu$  long, 5 to 6  $\mu$  thick. "Spermatia minute, straight, affixed to subsimple sterigma" (Nyl.).

On earth, widely distributed throughout our territory; San Bernardino Mountains, *Parish*; near Palm Springs, where it is quite abundant. North America; northern Europe; northern Africa; Asia and Oceania.

#### 40 *Lecidea crenata* (Taylor) Nyl.

Thallus consisting of thick, roundish squamules, pink to flesh-colored and brownish, at the central point of adherence concave, depressed at the circumference, from 1 to 6 mm. wide, beneath white; apothecia sessile, extremely marginal, from one to several on a squamule, 0.25 to 0.5 mm. in diameter, the disk purplish black to black, the at first reddish brown margin soon excluded; epithecium yellowish brown; thecium colorless; paraphyses stout, adglutinate; hypothecium of the same color as or sometimes paler than the epithecium; asci inflated-clavate; spores in 8's, ellipsoid, 9 to 14  $\mu$  long, 4 to 5  $\mu$  thick; thecium with iodine blue, soon changing to brown.

With the last preceding species on earth in exposed situations and apparently as widely distributed. At the foot of Tauquitz Canyon, Palm Springs, *Dudley*, (communicated by Herre); Slover Mount, *Parish*; Elsinore.

The forma *dealbata* Tuck. is a state with whitened thallus. Occasionally with the species.

#### 41. *Lecidea rubiformis* Wahlenb.

Thallus of smooth, glistening, erect or suberect, closely imbricated squamules, large, 4 to 8 mm. wide, dun or pale fawn color, paler at the margin and beneath, wavy, entire, subcrenate or lobulate; apothecia central, sessile, purplish black to black, globular, immarginate, not seldom conglomerate; epithecium brown; paraphyses closely coherent; the entire thecium sordid light brown; hypothecium brown; asci clavate; spores in 8's, round-ellipsoid, 10 to 12  $\mu$  long, 6  $\mu$  thick; spermatia short, straight, 6 to 7  $\mu$  long and barely 1  $\mu$  thick.

On earth in crevices of rocks, Tehachapi Mountains at 1,650 meters altitude. Arctic North America; Colorado; Europe.

#### 42. *Lecidea rufonigra* (Tuck.)

*Biatora rufonigra* Tuck. Syn. N. Amer. Lich. 2: 11. 1888.

Thallus of small (0.25 to 0.75 mm. wide) squamules, these approximate, subimbricate, brown, convex or now and then flat and undulating, with finely crenulate and thick, gray, pulverulent and blackening margin, beneath dark; apothecia sessile, numerous, 0.25 to 1 mm. in diameter; disk dark brown to black with a grayish, crenulate margin to convex and immarginate; epithecium brown, continuous; thecium 40  $\mu$  high; paraphyses coherent, some with globular brown heads; hypothecium colorless; asci clavate; spores in 8's, 6 to 10  $\mu$  long, 4  $\mu$  thick; hymenial gelatine with iodine blue.

On quartz, Verdugo near Los Angeles; at Elsinore on sandstone. Throughout North America.

#### 43. *Lecidea scotopholis* (Tuck.) Herre, Proc. Washington Acad. Sci. 12: 80. 1910.

*Biatora scotopholis* Tuck. Lich. Calif. 24. 1866.

Thallus crustaceous-squamulose, dark brown black; hypothallus black; squamules mostly convex, more or less glistening, their finely crenulate border often whitish; potassium hydrate and calcium chloride giving no change; apothecia of medium size, closely sessile; disk flat, dull black with a paler, grayish margin, this at last obscured by the more convex disk; epithecium pale brown; thecium 40 to 44  $\mu$  high, staining blue with iodine; spores ovoid-ellipsoid, 8 to 11  $\mu$  long, 4 to 5  $\mu$  thick.

On quartzose rocks. Los Gatos, *Herre*; Yosemite Valley, Santa Catalina Island, and throughout the higher ranges of the southern California mountains.



**44. *Lecidea lurida* (Swartz) Ach.**

Thallus cespitose, of closely imbricate, in outline sinuate squamæ, bright cervine brown and shining above, whitish beneath, somewhat smaller than those of *L. globifera*; apothecia 1 to 1.5 mm. wide, sessile near center of squama, flat, becoming slightly convex, red brown with a brown proper exciple; epithecium red brown, gradually paling downward; thecium tinged more or less pale brownish, the lower part almost colorless, about  $90\ \mu$  high; paraphyses closely coherent; asci clavate; hypothecium obscurely brownish; spores ellipsoid and oblong-ellipsoid, colorless, 11 to  $16\ \mu$  long, 5 to  $6\ \mu$  thick; hymenial gelatine staining with iodine blue, soon changing to a sordid vinous color.

On earth. Santa Monica Mountains above Sherman.

**CATILLARIA Mass.**

Thallus crustaceous, uniform or lobulate at the periphery, ecorticate; algæ Protococcus; apothecia circular, innate to sessile, with a pallid or colored or even horny proper margin and hypothecium; paraphyses not branching, separate or coherent, at times capitate and colored at the tips; asci 8-spored; spores generally small, ovoid, ellipsoid to oblong, straight or curved, bilocular, the spore membrane and septa thin, without a halo; spermatia cylindric to oblong-ellipsoid, straight or curved.

**KEY TO SPECIES.**

Growing on bark.

Thallus gray.

Effuse, often indistinct; apothecia purplish black. . . . 6. *C. glauconigrans*.

Coarsely granular; apothecia black. . . . . 1. *C. atropurpurea*.

Thallus white or whitish.

Minutely squamulose. . . . . 2. *C. globulosa*.

Minutely granulose. . . . . 3. *C. tricolor*.

Growing on rock.

Thallus absent. . . . . 4a. *C. lenticularis*  
*acrustacea*.

Thallus present, more or less gray.

Thin.

Dull olive gray, smooth. . . . . 4. *C. lenticularis*.

Rimose-areolate. . . . . 5. *C. chalybeia*.

Not thin; squamulose, ash color. . . . . 7. *C. franciscana*.

**1. *Catillaria atropurpurea* (Schaer.) T. Fries.**

Crust thin, gray, coarsely granular, often poorly developed; apothecia small, sessile; disk flat, purplish black to black; hypothecium pale; asci clavate; spores ellipsoid to oblong-ellipsoid, distinctly bilocular, slightly constricted and one loculus smaller (narrower) than the other,  $15\ \mu$  long, 6 to  $7\ \mu$  thick.

On bark of Lombardy poplar near Ballona, Los Angeles County.

**2. *Catillaria globulosa* (Floerke) T. Fries.**

Thallus dingy white or grayish, granulate to minutely squamulose and obsolete, KHO—, Ca (ClO)<sub>2</sub>—; apothecia numerous, scattered or crowded, small, 0.25 to 0.3 mm. in diameter, adnate; disk dull brown to dull black with a thin dark grayish, subcrenulate margin, later becoming convex and papillate, the margin disappearing (moistened the disk and margin of the juvenile apothecia are seen a dull dun color); epithecium brownish black, gradually paling downward; thecium faint grayish or colorless,  $60\ \mu$  high; paraphyses adglutinate; hypothecium colorless; asci clavate; spores oblong or narrowly ellipsoid, some faintly bilocular, 9 to  $13\ \mu$  long, 4 to  $7\ \mu$  thick; hymenial gelatine with iodine intense blue.



On old fence boards near San Francisco, *Gray*; dead pine branchlets at Pacific Grove, *Herre*; on denuded pine wood, Tehachapi Mountains, at 1,650 meters altitude. New England States and Canada. Europe and northern Africa.

**3. *Catillaria tricolor* (With.) T. Fries.**

Thallus whitish to ash gray, minutely granulose,  $\text{KHO} + \text{yellow}$ ,  $\text{Ca}(\text{ClO})_2 -$ ; apothecia minute, sessile, the disk brownish, flat and with a thin, paler, pulverulent margin, later becoming darker, the margin disappearing; epithecium subgranulose, pale brownish; thecium  $56\ \mu$  high, colorless; paraphyses subcoherent, capitate at the brownish tips; hypothecium colorless; asci clavate; spores bilocular, oblong, 9 to  $12\ \mu$  long,  $3.5$  to  $4\ \mu$  thick, some slightly curved, others apparently simple.

On various barks. Tuckerman distinguishes a variety *atlantica* "with spores scarcely other than simple," from variety *pacifica*, with typical spores and a decussating black hypothallus. Santa Cruz Mountains, the variety *pacifica*, *Herre*, and Alameda County, *Gray*. In the Santa Monica Mountains both varieties occur on the same piece of bark.

**4. *Catillaria lenticularis* (Ach.) T. Fries.**

Crust sordid olive greenish gray, finely and obscurely rimose-areolate, minutely granulose, effigurate,  $\text{KHO} -$ ; apothecia small, from 0.25 to 0.5 mm. in diameter, dispersed, the disk brown black to black, flat with a regular, elevated margin, later convex and immarginate; epithecium subcontinuous, brown to dark brown; thecium 56 to  $60\ \mu$  high; colorless; paraphyses loosely coherent with globular, dark brown black heads; hypothecium pallid or pale brownish; asci clavate; spores faintly bilocular, narrowly ellipsoid, 8 to  $12.5\ \mu$  long, 2 to  $3\ \mu$  thick, the membrane thin; hymenial gelatine with iodine blue, excepting the epithecium and hypothecium, these not affected by the reagent.

This is the forma *vulgaris* of authors. On slate rock in the Santa Monica Range.

**4a. *Catillaria lenticularis* forma *acrustacea* Hepp.**

Thallus absent; apothecia numerous, crowded, attaining a somewhat greater diameter than the species, the disk black, flat to lightly convex, the margin subpersistent; epithecium dark brown, paling downward; thecium about  $80\ \mu$  high; paraphyses loosely coherent, grayish or brownish gray, capitate; asci narrowly clavate; hypothecium nearly or entirely colorless; spores bilocular, narrowly ellipsoid, 14 to  $15\ \mu$  long, 4 to  $5\ \mu$  thick; hymenial gelatine with iodine blue.

Sandstone boulder on Santa Catalina Island.

**5. *Catillaria chalybeia* (Borr.).**

*Lecidea chalybeia* Borr.; Leight. Lichenfl. Brit. ed. 3. 326. 1879.

Crust thin, smooth, ashy gray, finely rimose-areolate,  $\text{KHO} -$ ,  $\text{Ca}(\text{ClO})_2 -$ ; apothecia sessile, dispersed, small, 0.3 to 0.5 mm. in diameter, the disk flat to slightly convex, black; margin persistent, regular and entire; epithecium brown; paraphyses quite separate with abruptly capitate, brown heads; thecium 52 to  $60\ \mu$  high; hypothecium brown; asci inflated-clavate, about  $42\ \mu$  long,  $12\ \mu$  thick; spores fusiform-ellipsoid and narrowly ellipsoid, bilocular, acuminate at the ends, 10 to  $12\ \mu$  long, 3 to  $4\ \mu$  thick; hymenial gelatine with iodine light blue.

On trap, north fork of Matilija Canyon, Ventura County.

**6. *Catillaria glauconigrans* (Tuck.).**

*Biatora glauconigrans* Tuck. Proc. Amer. Acad. 12: 179. 1877.

Thallus thin, ash gray, effuse and indistinct; apothecia minute to small, adnate, the disk black, flat to planoconvex, the margin concolorous and persistent, regular, entire; epithecium granulose, black brown; thecium colorless, 60 to  $64\ \mu$  high; paraphyses free, some of them globular-thickened and dark at the apices; hypothecium brown, of lighter shade than the epithecium; asci clavate, 40 to  $44\ \mu$  long, 7 to  $8\ \mu$  thick; spores bilocular, ellipsoid, 6 to  $11\ \mu$  long, 2 to  $3\ \mu$  thick.

On bark of *Rhus diversiloba*, canyons of Santa Monica Range.



**7. *Catillaria franciscana* (Tuck.) Herre, Proc. Washington Acad. Sci. 12: 95. 1910.**

*Biatora franciscana* Tuck. Syn. N. Amer. Lich. 2: 32. 1888.

Thallus of whitish to gray, scattered or crowded squamules; apothecia small to middling size, 0.5 to 0.8 mm. in diameter, the disk from flat to convex, and the at first somewhat paler proper margin disappearing, the blackish disk often with a bloom; epithecium dark violaceous black; paraphyses separate, gray, capitate; thecium 60 to 64  $\mu$  high; hypothecium colorless or sordid; asci cylindric-clavate, 40  $\mu$  long, 10 to 12  $\mu$  thick; spores bilocular, oblong, 12 to 22  $\mu$  long, 3.5 to 5  $\mu$  thick; hymenial gelatine with iodine blue, soon changing to claret brown.

On argillaceous and other rocks in the Santa Monica Range; at Newport; bluffs at White Point, near San Pedro.

**BACIDIA De Not.**

Thallus crustaceous, uniform, ecorticate, with Protococcus gonidia; apothecia circular, sessile for the greater part; disk flat or convex, the proper margin and hypothecium pale or dark; paraphyses not branched, loose or coherent, often with capitate apices; asci 8 to 16-spored; spores colorless, parallel 3-locular to plurilocular, fusiform to acicular, both ends alike or one caudate-acuminate, straight, curved, or spirally interwoven, with cylindric loculi, the septa thin, often indistinct, without a gelatinous halo; spermatia short-cylindric to acicular, straight or curved.

**KEY TO SPECIES.**

**Substratum mineral.**

Growing on earth..... 1. *B. gyalectiformis*.

**Growing on rock.**

Thallus dark..... 10. *B. umbrina*.

Thallus light colored..... 11. *B. kingmani*.

**Substratum vegetable.**

Growing on wood; thallus light colored..... 2. *B. milliaria*.

**Growing on bark.**

**Spores 3 or 4-locular.**

Thallus staining yellow with KHO..... 4. *B. jacobi*.

Thallus not staining with KHO..... 3. *B. naegelii*.

**Spores more than 4-locular.**

**Spores 10 to 17-locular.**

Apothecia brown to dark brown..... 5. *B. fuscorubella*.

Apothecia black..... 7. *B. clementis*.

**Spores plurilocular, acicular, one end attenuate.**

Apothecia light pink to flesh-colored..... 9. *B. albescens*.

**Apothecia more or less black.**

Brown black..... 8. *B. endoleuca*.

Fawn color to black purple..... 6. *B. rubella*.

**1. *Bacidia gyalectiformis* (Zahlbr.).**

*Bilimbia gyalectiformis* Zahlbr. Beih. Bot. Centralbl. 13: 158. 1902.

Thallus dingy white, pulverulent, rugulose, effuse, irregularly rimose, KHO—, Ca(ClO)<sub>2</sub>—; apothecia dispersed, immersed, gyalectiform, surrounded by a subcoarctate spurious thalline margin; disk flat, reddish to blackish brown; epithecium continuous, pale yellowish brownish; thecium colorless, 100 to 128  $\mu$  high; paraphyses slender, subcoherent, not thickened at the apices; hypothecium colorless to yellowish; asci about 104  $\mu$  long, 20  $\mu$  thick; spores 8 in asci, ellipsoid to oblong-ellipsoid, straight, 4-locular, 20 to 28  $\mu$  long, 6 to 7  $\mu$  thick; hymenial gelatine pale blue with iodine.



On sandy earth and at eastern base of San Jacinto Mountains, near Palm Springs, at 170 meters alt.

Type specimen deposited with Dr. A. Zahlbruckner; duplicates in the U. S. National Herbarium and in herb. Hasse.

## 2. *Bacidia milliaria* (Fries) Koerb.

Only the forma *ligniaria*, with the following characters, is represented in our flora.

Crust thin, effuse, granular, and minutely squamulose, the squamules dispersed or congregated and obscurely rimose, KHO—, Ca(ClO)<sub>2</sub>—; apothecia small, 0.5 to 0.75 mm. in diameter, sessile, purplish black; disk flattened, opaque, the margin thin, entire, elevated, later convex and subglobular, then black and the margin disappearing; epithecium reddish brown or violaceous, gradually paling downward; paraphyses loosely coherent or some with vinous red small heads; thecium about 60  $\mu$  high, colorless, at least the lower part; hypothecium pallid to pale yellowish; asci clavate, 48 to 52  $\mu$  high, 8 to 12  $\mu$  thick, equaling the thecium in height; spores acicular or thin fusiform, 28 to 32  $\mu$  long, 3.5 to 4  $\mu$  thick, 4 to 7-locular.

On dead, decorticated wood, Tehachapi Mountains, at 1,700 meters altitude. Eastern United States and Europe.

## 3. *Bacidia naegelii* (Hepp) Zahlbr. in Engl. & Prantl, Nat. Pflanzenfam. 1<sup>1\*</sup>: 135. 1907.

*Biatora naegelii* Hepp, Spor. Flecht. Eur. pl. 4. f. 1, 19. 1853.

Thallus whitish to sordid olive green, coarsely granular, effuse, thin; apothecia small, 0.75 to 0.8 mm. in diameter, scattered or crowded to confluent; disk dull brown, gradually darkening to black, apparently convex from the first, the lighter colored, dark gray proper margin not prominent and at last obsolete; epithecium partly colorless, partly bluish blackish; paraphyses coherent, their clavate apices bluish blackish; hypothecium colorless; asci inflated-clavate; spores fusiform, ellipsoid, straight or lightly curved, mostly 4-locular, 16 to 24  $\mu$  long, 3.5 to 5  $\mu$  thick; hymenial gelatine blue with iodine.

On various living and dead barks, Washington, *Foster*; Santa Cruz Peninsula, *Herre*; in canyons of the Santa Monica Mountains. Eastern United States. Europe.

## 4. *Bacidia jacobi* (Tuck.).

*Biatora jacobi* Tuck. Syn. N. Amer. Lich. 2: 48. 1888.

Thallus white to light ash gray, minutely scurfy or pulverulent, effuse, forming small white patches, KHO+ yellow, Ca(ClO)<sub>2</sub>—; hypothallus apparently pallid; apothecia appressed, small, 0.25 to 0.3 mm. in diameter, one or several on a thalline patch; disk flat to planoconvex, black with a thin, entire, persistent, concolorous margin, but this finally obscured; epithecium granulose, fuliginous brown; thecium 48 to 56  $\mu$  high; paraphyses subcoherent, indistinct with abruptly thickened, black heads; hypothecium of the same dark color with the epithecium; asci clavate to inflated-clavate, nearly equaling the thecium in height, 36 to 48  $\mu$  long, 14 to 16  $\mu$  thick; spores fusiform, one end long-attenuate, the other short-acuminate, 4-locular, slightly curved, 20 to 26  $\mu$  long, 2 to 3  $\mu$  thick; hymenial gelatine with iodine light blue, the tops of asci darker and changing to violet; spermogones not found.

On bark of *Malvastrum fasciculatum*, in canyons of the Santa Monica Range. Type locality, "San Diego," collected by Doctor Palmer on trees.

## 5. *Bacidia fuscorubella* (Hoffm.) Arnold.

Thallus crust whitish to cinerascens, granulate-roughened and obsoletely rimose, effuse; apothecia sessile, 0.25 to 0.6 mm. in diameter; disk brown black to black and flat with a thin, concolorous margin to convex, papillate, and immarginate; epithecium brown; thecium of same color with the hypothecium, dingy yellowish gray, and scarcely higher than the asci; asci clavate, 80  $\mu$  long, 12  $\mu$  thick; spores blunt at each end, 40 to 76  $\mu$  long, 4  $\mu$  thick, 14 or 15-locular.

On various barks in the Santa Monica Range.



**6. *Bacidia rubella* (Hoffm.) Mass.**

Crust pale gray to pale greenish ash color, thin, effuse, granulose; apothecia sessile, small, 0.25 to 1 mm. in diameter; disk flat, finally convex and from fawn color to blackish purple, the margin at first delicately pruinose (which is forma *porriginosa* (Turn.) Arn.), later naked, (forma *luteola* (Schrad.) T. Fries); epithecium continuous, colorless, 72 to 80  $\mu$  high; paraphyses coherent, slightly thickened above but colorless; hypothecium colorless; asci clavate, 68  $\mu$  long, 12  $\mu$  thick; spores acicular, one end finely attenuate, 48 to 68  $\mu$  long, 2 to 3  $\mu$  thick, indistinctly plurilocular, straight or slightly curved; thecium, epithecium, and hypothecium blue with iodine; thallus KHO—.

On living barks, Santa Monica Range. North America and Europe.

**7. *Bacidia clementis* Hasse, Bryologist 13: 61. 1910.**

Thallus crust moderately thick, whitish, coarsely granular and rugulose, becoming chinky, KHO—,  $\text{Ca}(\text{ClO})_2$ —; apothecia sessile, small, 0.2 to 0.8 mm. in width; disk flat, brown black, the proper margin entire, concolorous, soon becoming convex, black and the margin obsolete; epithecium colorless, granulose; thecium colorless to pale brown at the periphery; paraphyses not coherent, not thickened nor colored at the apices; asci clavate to subcylindric; 68 to 112  $\mu$  high, 12 to 16  $\mu$  thick, the membrane not at all or slightly thickened at the top in the larger sacks; spores cylindric, 60 to 80  $\mu$  long, 4 to 5  $\mu$  thick, both ends equally bluntly rounded without attenuation, once or twice gently curved, 15 to 17-locular; hymenial gelatine giving no reaction with iodine, only the asci becoming yellow, the juvenile, immature ones darker, the escaped spores not staining with iodine; hypothecium yellowish gray to brown; spermogones minute black protrusions on the thallus; sterigma straight, simple; spermatia acicular, straight or slightly curved, 10 to 12  $\mu$  long.

On bark of *Heteromeles arbutifolia*, San Clemente Island, Trask in 1893. In 1903 collected on the same bark in the Santa Ynez Canyon of the Santa Monica Range. Type deposited in herb. Hasse.

This species is near *Bacidia fuscorubella*, with which it was at first confounded, but differs in the length of its spores and in its chemical reactions.

**8. *Bacidia endoleuca* (Nyl.) Kickx.**

Crust thin, granulate, effuse, greenish gray; apothecia sessile, scattered, 0.25 to 1 mm. wide; disk brown black to black, marginate, flat to convex, the margin not quite disappearing; epithecium subcontinuous, umber brown and gray, gradually paling downward; thecium colorless, 52 to 80  $\mu$  high; paraphyses loosely coherent, clavate at the tips; hypothecium pale yellowish; asci clavate; spores acicular, slightly thicker at upper end, gradually attenuate at the other, multiseptate, 28 to 60  $\mu$  long, 1 to 4.5  $\mu$  thick; hymenial gelatine with iodine blue, turning dingy brown; epithecium and hypothecium not stained by iodine.

On various barks; "Mission Ridge" at Santa Barbara, Herre; canyons of San Gabriel Range, Los Angeles County. Southern North America to South America; Europe; Japan.

**9. *Bacidia albescens* (Arnold) Zwackh.**

Crust thin, effuse, silver gray to ash color, pulverulent and granular; apothecia minute to small, up to 0.6 mm. wide, sessile, scattered; disk flattish, marginate to more convex and immarginate, from light pink to flesh color; epithecium subcontinuous, light yellowish brown paling downward, becoming light grayish brown at the periphery; thecium 60  $\mu$  high, colorless; paraphyses coherent, clavate at apices; hypothecium colorless; asci clavate, 48 to 52  $\mu$  long, 8 to 10  $\mu$  thick; spores acicular, slender, one end slightly thickened, the other attenuate, 28 to 44  $\mu$  long, 2  $\mu$  thick pluriseptate; hymenial gelatine blue with iodine, including the epithecium and hypothecium.



On various living barks, Santa Monica Range. New England States; tropical America, Cuba; Europe; Japan.

**10. *Bacidia umbrina* (Ach.) Branth & Rostr.**

Crust pale ash to sordid blackish olive green color, of coarse, flattened and irregular-shaped granules, when dry accumulated into warty, obscurely rimose elevations, when moistened the crust dark black green and the granules contiguous; apothecia subinnate to adnate, 0.25 to 1 mm. wide; disk black, plane with a thin, concolorous margin, later the disk becoming almost semiglobular, the margin vanishing; epithecium blackish brown; thecium 60  $\mu$  high; almost colorless; paraphyses intricately interwoven; hypothecium similar in color to the epithecium; asci inflated-clavate, the membrane thick; spores acicular, bowed and doubly arcuate, the ends blunt, one rounded, 16 to 28  $\mu$  long, 3.5 to 5  $\mu$  thick, mostly 4-locular, intertwined in the spore sack and thus giving the appearance of a multisporeous ascus.

On sandstone, Ballona Bluffs near Santa Monica; at Santa Barbara. Eastern United States; Europe.

Our plant is the forma *psotina* (Fries) T. Fries with the heads of the paraphyses sordid olivaceous brown.

**11. *Bacidia kingmani* Hasse, Bryologist 14: 101. 1911.**

Thallus poorly represented by small congregated or scattered, sordid light olive green, imbricated squamules, or evanescent; squamules about 0.5 mm. wide, flat or conchiform; hypothallus indistinct; apothecia sessile or substipitate, 2 to 3.5 mm. wide; disk dull black, flat to convex, often with a faint grayish bloom, the persistent proper margin turgid, gray pruinose, generally strongly crenate-sinuose; epithecium subcontinuous, bluish black; thecium colorless, 88  $\mu$  high; paraphyses coarse, scarcely thickened above, with light brown tips; hypothecium dark brown, thicker than the thecium; asci narrowly clavate, not reaching the epithecium, 8 to 10  $\mu$  thick, often slightly curved, the septa indistinct; hymenial gelatine staining dark blue with iodine.

On quartzose rock in the San Gabriel Range along the "New Trail" to Mount Wilson. Collected by Mr. C. C. Kingman.

Type in the herbarium of the collector; duplicate in the author's herbarium.

**TONINIA Mass.**

Thallus crustaceous-squamulose, rugose to caudate, lobate at the periphery; gonidia Pleurococcus; apothecia circular, sessile, biatorine or lecideine, without a lecanorine margin; paraphyses simple, discrete or coherent, thickened and often capitate at the tips; hypothecium pallid or dark; ascus membranes thin; spores in 8's, elongated-ellipsoid to almost staff-shaped, parallel-bilocular to parallel-plurilocular, the loculi cylindric, the wall thin, without a halo; spermogones immersed, spermatia capillary or acicular, curved, rarely straightened.

**KEY TO SPECIES.**

Growing on earth.

Thallus bullate, gray to brown gray..... 1. *T. coeruleonigricans*.

Thallus not bullate.

Squamulose, pale gray..... 2. *T. cumulata*.

Verruculose, of small gray warts..... 6. *T. massata*.

Growing on rock; thallus squamulose.

Squamules cervine brown, thick.

Spores 5-locular..... 3. *T. squarrosa*.

Spores more than 5-locular..... 3a. *T. squarrosa persimilans*.

Squamules not cervine brown.

Blackish..... 4. *T. ruginosa*.

Gray with a shade of green..... 5. *T. aromatica*.



**1. *Toninia coeruleonigricans* (Lightf.) T. Fries.**

Thallus of bullous, semiglobular squamæ, discrete or crowded, dull brown or dingy greenish gray, naked or pruinose, the larger sublobate; apothecia substipitate between the squamæ, of middling size to large; disk black, flat-convex, the margin indistinct and with the later increasing convexity of the disk almost disappearing; paraphyses loose, the tips fuliginous, capitate; asci clavate; spores bilocular, fusiform, 14 to 26  $\mu$  long, 2 to 4  $\mu$  thick; hymenial gelatine with iodine blue changing to reddish.

On earth "in mountainous and high northern regions" (Tuckerman), but we have it in southern California and, as at Palm Springs, at only 170 meters above sea level; at the north fork of the Matilija Canyon, in Ventura County. Rocky Mountain States; Europe; northern Asia and northern Africa.

**2. *Toninia cumulata* (Sommerf.) T. Fries.**

Thallus of small, white or pale gray squamules, these irregularly shaped, scattered or contiguous, KHO—,  $\text{Ca}(\text{ClO})_2$ —, the medullary hyphæ giving no reaction with iodine; apothecia small and mostly congregated into prominent heaps; disk in the isolated apothecia round, flat, black, with a raised, thick, black, entire or crenulate margin, the disk later becoming slightly convex, the margin thinner to almost disappearing; epithecium subgranulose, dark brown; thecium dark, 72  $\mu$  high; paraphyses coherent, the brown heads clavate; hypothecium yellowish or reddish brown, not as dark as the epithecium; asci clavate and subinflated-clavate, 62  $\mu$  long, 12  $\mu$  thick; spores 4-locular, fusiform-ellipsoid, 14 to 18  $\mu$  long, 4.5 to 6  $\mu$  thick, the ends slightly acuminate, one more so than the other; hymenial gelatine blue with iodine.

On sandy clay bluffs near Newport, Orange County. Subalpine northern Europe and arctic regions of North America.

**3. *Toninia squarrosa* (Ach.) T. Fries.**

Thallus cervine brown, squamulose, thick, the squamules congregated, subimbricate, lobulate, rugose and convolute, KHO—; apothecia sessile, medium-sized to large and conglomerate; disk black, at first flat, margined, passing to strongly convex, lobulate and immarginate; epithecium subcontinuous, bluish blackish; thecium colorless, 60 to 64  $\mu$  high, with iodine blue, but the epithecium and hypothecium not affected; paraphyses coherent, strict, their apices clavate and bluish black; hypothecium sordid pale yellowish; asci subinflated-clavate; spores straight or lightly curved, acicular-fusiform, one end thicker and blunt, the other attenuate, about 4-septate, the septation faint, 23 to 40  $\mu$  long, 2 to 3.5  $\mu$  thick.

Forming cushions among moss on rocks; mountains of northeastern California, *Herre*; Yosemite Valley; Strawberry Valley, San Jacinto Mountains, at 1,600 meters altitude. Alpine and arctic regions of western North America; northern Asia; Europe.

**3a. *Toninia squarrosa persimilans* Hasse, subsp. nov.**

*Lecidea squarrosa persimilans* Nyl. in litt.

Varies from the species in the spores, which are 37 to 68  $\mu$  long and 4  $\mu$  thick, and from 4-locular to plurilocular, narrowly fusiform, one end gradually attenuate, the other abruptly acuminate or blunt in some spores.

On earth in the San Gabriel Range, Los Angeles County, on the "Old Wilson Trail" at 830 meters altitude (the type locality).

Type deposited with Prof. Bruce Fink; duplicates in U. S. National Herbarium and in herb. Hasse.

**4. *Toninia ruginosa* (Tuck.) Herre, Proc. Washington Acad. Sci. 12: 103. 1910.**

*Lecidea ruginosa* Tuck. Lich. Calif. 25. 1866.

Thallus of rounded, turgid, bullose squamules, more or less crowded, wavy and rugose-plicate, finally cancellate, from blackish green to brown; "apothecia ample to large, 1.5 to 3 mm. in width, flat, at length flexuose-lobate, scarcely excluding the stout margin;" epithecium subgranulose, brown; thecium colorless to light brown,



56 to 60  $\mu$  high; paraphyses laxly coherent, with brownish clavate tips or colorless in the same apothecium; hypothecium sordid yellowish to yellowish brown; spores acicular-fusiform, attenuate-caudate at one end, at the other blunt, 25 to 30  $\mu$  long, 3 to 4  $\mu$  thick, faintly pluriseptate; hymenial gelatine blue with iodine, KHO staining the epithecium a violet purple; no change with  $\text{NO}_5$ .

On rocks, north fork of Matilija Canyon, Ventura County. Coast of California.

**5. *Toninia aromatica* (J. E. Smith) Mass.**

Thallus of rugulose, contorted, greenish gray or sordid pale olive green squamules, these congested and subimbricated, with a crenulate-lobulate border; apothecia sessile, now and then conglomerate or clustered; disk black, round with an entire margin to convex with the margin obsolete; epithecium subcontinuous, dark brown; thecium 40 to 60  $\mu$  high, colorless to slightly yellowish tinted; paraphyses strict, loosely coherent, entire, simple, some clavate and with grayish violet tips; hypothecium dark yellowish brown, nearly as high as the thecium; asci clavate; spores dactyliform-cylindric or narrow fusiform, both ends obtuse, 4-locular, 10 to 26  $\mu$  long, 4 to 5  $\mu$  thick; hymenial gelatine with iodine blue, changing to reddish brown, KHO staining the epithecium violet.

On sandrock near Mayfield, *Herre*; Santa Catalina Island; Santa Monica Range; at Murietta Hot Springs, Riverside County. Europe; Africa.

**6. *Toninia massata* (Tuck.) Herre, Proc. Washington Acad. Sci. 12: 103. 1910.**

*Lecidea massata* Tuck. Lich. Calif. 25. 1866.

Thallus of loosely aggregate, gray verrucæ the size of a poppy seed or less, forming a rimose crust, KHO+pale yellow,  $\text{Ca}(\text{ClO})_2$ —; hypothallus indistinct; apothecia numerous, interspersed among the thalline verrucæ and barely as large as these, innate-sessile; disk black, smooth and soon convex and immarginate; epithecium granulose, brown; thecium sordid yellow, with iodine blue, soon changing to red brown; paraphyses adglutinate and indistinct; hypothecium thick, dark brown, as thick as or thicker than the thecium; asci subinflated-clavate, 36  $\mu$  long, 16  $\mu$  thick; spores bilocular, 12 to 15  $\mu$  long, 4 to 5  $\mu$  thick; thecium about 40  $\mu$  high; hymenial gelatine stained blue with iodine, soon changing to red brown.

On earth, Santa Monica Mountains; Verdugo Mountains near Los Angeles; at Point Loma near San Diego.

**RHIZOCARPON Ramond.**

Thallus crustaceous, uniform; apothecia lecideine, circular, sessile or innate upon or between the thalline squamules, with a black carbonaceous margin and a dark hypothecium; hymenium gelatinous; paraphyses branching, lax and interwoven; asci containing 1 to 8 spores; spores colorless or brown or dark from the first, parallel-bilocular to more locular or muriform, with a gelatinous halo; spermatia cylindric to acicular, straight or nearly so.

**KEY TO SPECIES.**

- |   |                             |
|---|-----------------------------|
| Growing on earth; spores not colored.....           | 6. <i>R. athalloides</i> .  |
| Growing on rock.                                    |                             |
| Spores not colored.....                             | 5. <i>R. distinctum</i> .   |
| Spores dark.  |                             |
| Thallus some shade of yellow.                       |                             |
| Bright yellow, areolate.....                        | 1. <i>R. geographicum</i> . |
| Dull greenish yellow, consisting of small verrucæ.. | 2. <i>R. viridiatrum</i> .  |
| Thallus not yellow.                                 |                             |
| Thallus brown.....                                  | 7. <i>R. bolanderi</i> .    |
| Not brown.  |                             |
| Gray, spores 2.....                                 | 3. <i>R. geminatum</i> .    |
| Whitish, spores 4 to 8.....                         | 4. <i>R. petraeum</i> .     |



**1. *Rhizocarpon geographicum* (L.) Lam. & DC.**

Thallus yellow and greenish yellow, areolate, the areoles flat, contiguous (forma *contigua* Fries) or dispersed, with a distinct hypothallus; apothecia small, scarcely exceeding 0.5 mm. in width, impressed, the disk black, mostly angular, the margin black, thin; apothecia numerous, often crowded, interspersed among the areoles (the typical form) or encircled by an areole (forma *lecanorina* Floerke); epithecium continuous, light yellowish brown; thecium about 160  $\mu$  high, colorless or of a pale yellowish brown tint; paraphyses stout, 2 to 4  $\mu$  thick, their outlines not clean cut, containing many guttulæ; hypothecium dark brown, gradually paling upward; asci ventricose; spores variously shaped, short-ellipsoid or oblong, 4-locular but mainly muriform, dark brown, the loculi with a bluish black tint, mostly with 3 main septa and additional secondary, thinner partitions, 30 to 40  $\mu$  long, 14 to 20  $\mu$  thick; hymenial gelatine blue with iodine.

On hard crystalline rocks. Santa Cruz Mountains at 928 meters altitude, *Herre*; in the mountains of southern California at about 1,000 meters and ascending thence. From the central part of North America to arctic regions; Europe. The forms occur together and with the type.

**2. *Rhizocarpon viridiatrum* (Floerke) Koerb.**

Thallus greenish yellow, areolate, the areoles distinctly verruculose, pulverulent; hypothallus black; apothecia arising from the black hypothallus, subsessile, protruding above the level of the thallus and somewhat larger than in the preceding species, the disk dull black, flat to convex, papillate or roughened, the margin somewhat brown black, crenulate, long-persistent; spores as in *R. geographicum*.

On trap rock, Topanga Canyon, Santa Monica Range. Europe.

The thallus does not spread so wide as in *R. geographicum* and appears dusky from fine capillary lines extending over the areoles.

**3. *Rhizocarpon geminatum* (Flot.) Koerb.**

Crust verrucose-areolate, dark ash gray with a faint shade of red or brown, scattered or approximate; hypothallus not very distinct; apothecia sessile; disk flat, black, the margin slightly elevated, entire, and persistent; epithecium granulose, violaceous black; thecium pallid; paraphyses coherent; hypothecium black brown; asci ventricose; spores one or two in the asci, 28 to 36  $\mu$  long, 16 to 20  $\mu$  thick, dark brown; hymenial gelatine staining an intense blue with iodine, especially the epithecium, this becoming almost black; no change with  $\text{NO}_5$ .

On rocks. Santa Cruz Mountains, *Herre*; San Bernardino Mountains near "Seven Oaks" at 2,000 meters altitude.

**4. *Rhizocarpon petraeum* (Wulf.) Koerb.**

Thallus as in the preceding, not stained by KHO; spores 6 to 8 in the asci, oblong, brown, 4 to 5-locular and submuriform with a thick halo, 22 to 32  $\mu$  long, 10 to 16  $\mu$  thick; hymenial gelatine with iodine blue; no change with KHO or  $\text{NO}_5$ .

With the preceding. Throughout the greater part of North America; Europe.

**5. *Rhizocarpon distinctum* T. Fries.**

Thallus whitish to leaden gray, interruptedly rimose-areolate, the areoles small, flattish or concave, KHO—,  $\text{Ca}(\text{ClO})_2$ —; hypothallus black; apothecia adnate, small, 0.5 to 0.75 mm. wide, the disk dull black, flat, papillate, with a thin, yellowish gray, at first slightly elevated margin, later obsolete as the disk becomes convex; epithecium brown black, gradually paling downward, with KHO pale violaceous; thecium pallid, with iodine blue; paraphyses coarse; spores muriform, colorless, oblong-ellipsoid, 24 to 36  $\mu$  long; 12 to 16  $\mu$  thick.

On argillaceous sandstone and shale, near Pescadero and near New Almaden, *Herre*; may extend to southern California.



**6. *Rhizocarpon athalloides* (Nyl.)**

*Lecidea athalloides* Nyl. Bull. Soc. Bot. France 7: 503. 1860.

Crust gelatinous when moist, indeterminate, sordid whitish ochraceous, indistinctly rimose or granulate, of a loose web of hyphæ, KHO—, Ca(ClO)<sub>2</sub>—; apothecia innate, 0.5 to 1.5 mm. wide, primarily covered by a thallus that finally ruptures, leaving a coarctate, lacerated rim surrounding the dull black, flat or gently convex disk, when moist with a shade of brown, round or irregularly oblong with an indistinct, entire or crenulate and wavy proper margin; epithecium pale sordid yellowish, subgranulose; thecium 120 to 124  $\mu$  high, colorless or nearly so; paraphyses slender, adglutinated, gelatinous; hypothecium slightly darker than the epithecium, darkening to yellowish brown; asci subventricose, shorter than the thecium, ill-defined; spores 4 or 5 in the asci, ovoid, 4 to 5-locular and submuriform, 32 to 40  $\mu$  long, 14 to 20  $\mu$  thick; no reaction of the thecial structures with KHO or Ca(ClO)<sub>2</sub>; hymenial gelatine with iodine a pale vinous red, with NO<sub>5</sub> no change except a darkening of epithecium and hypothecium.

On earth; foothills of Santa Monica Range and Verdugo Mountains near Los Angeles. Europe on the Island of Corsica.

**7. *Rhizocarpon bolanderi* (Tuck.) Herre, Proc. Washington Acad. Sci. 12: 106. 1910.**

*Buellia bolanderi* Tuck. Gen. Lich. 189. 1872.

Crust dark chestnut, of small, round or wavy squamules, separate or approximate, upon a conspicuous black hypothallus, giving the crust an almost black appearance. KHO—, Ca(ClO)<sub>2</sub>—, medullary hyphæ with iodine—; apothecia adnate, 0.3 to 1 mm. wide; disk dull black, flat to convex, with a concolorous, erect, horny margin, this at last disappearing; epithecium dark brown; thecium pallid, 100  $\mu$  high; paraphyses loosely coherent; hypothecium dark brown; asci saccate, 68  $\mu$  to nearly as high as the thecium, 24  $\mu$  thick; spores 2 in the asci, from colorless to gray and intensely brown black, 32 to 72  $\mu$  long, 20 to 36  $\mu$  thick, muriform; hymenial gelatine of an intense blue with iodine.

A montane lichen, rare below 300 meters elevation. Santa Cruz Mountains, *Herre*, at 1,260 meters; throughout the San Gabriel and San Bernardino Ranges; on Santa Catalina Island.

**CLADONIACEAE.**

Of the several genera classed in this family, the only one reported from our district is the following:

**CLADONIA Hiller.**

Thallus squamaceous to foliaceous, of two parts conveniently designated as horizontal or primary and erect or secondary, the latter of greatly varying size and shape, constituting the "podetia;" apothecia sessile upon the apices of the podetia or rims of the cups, rarely sessile directly upon the squamous or foliaceous primary thallus, biatorine, with a proper, but without a thalline margin; paraphyses simple, coherent; hypothecium pallid or colored; asci clavate, 6 to 8-spored; spores colorless, simple, ovoid, oblong to fusiform, rarely bilocular or trilocular; spermogones situated at the tips of the podetia or on the corresponding rims of the cups, exceptionally on the primary thallus; spermatia cylindric or acicular, nearly straight.

The species concerning us come under the subseries Ochrophaeae Wainio, of the subgenus *Cenomyce* (Ach.) T. Fries, briefly characterized by pallid or light brown apothecia, the podetia not cup-bearing or with cups at their tips; spores simple. In ours the apothecia are brown.



## KEY TO SPECIES.

Podetia not cup bearing.

- Dichotomously branching..... 1. *C. furcata racemosa*.  
 Corymbosely branching..... 2. *C. furcata corymbosa*.

Podetia cup bearing.

Cups well developed.

Cortex of cups and podetia verruculose.

- Cups more or less proliferous..... 7. *C. verticillata subcervicornis*.  
 Cups not or slightly proliferous.

- Primary thallus large..... 4. *C. pyxidata pocillum*.  
 Primary thallus not large..... 3. *C. pyxidata*.

Cortex of cups and podetia not verruculose.

- Granulose, pale sulphur-colored..... 5. *C. pyxidata chlorophaea*.  
 Furfuraceous, grayish white..... 11. *C. pityrea*.

Cups not well developed.

- Contracted; cortex finely pulverulent..... 8. *C. fimbriata simplex*.

Abortive or absent.

Podetia present, considerably developed.

- Podetia long, subulate..... 9. *C. fimbriata subulata*.  
 Podetia not subulate, clavate above. 10. *C. fimbriata clavata*.

- Podetia short or none; apothecia sessile. 6. *C. caespiticia*.

**1. *Cladonia furcata racemosa* Floerke.**

Primary thallus sparingly present, persistent, the squamules oblong, crenate, lobulate, light green above, white beneath; podetia moderately elongate, white above, ash or pinkish ash below, sparingly branched, branches erect or suberect, bifurcate below the tips, beset with crenulate squamules of the same color as the primary thallus, not pervious in the axils, KHO—, Ca (ClO)<sub>2</sub>—.

On earth at San Diego.

**2. *Cladonia furcata corymbosa* (Ach.) Nyl.**

Primary thallus evanescent; podetia 25 to 60 mm. high, white throughout, dichotomously divided above, the branchlets redivided and bearing small, globose, light brown apothecia at the ends of the corymbosely arranged terminations, the stem sparingly squamulose, beset with small to minute, entirely white squamules or the larger green above, with KHO pale yellow (only the squamules); hymenial gelatine with iodine blue soon turning yellow, the hypothecium, however, retaining the blue stain.

On earth near San Francisco, *Gray*; the same from Washington, *Foster*, very luxuriant, 1 cm. high, more sparingly squamulose, KHO—, Ca(ClO)<sub>2</sub>—; spores fusiform-ellipsoid, often slightly curved, 10 to 15  $\mu$  long, 3 to 4  $\mu$  thick; also the same from Santa Catalina Island.

**3. *Cladonia pyxidata* (L.) Hoffm.**

Primary thallus of small squamules, dull grayish green above, white beneath, crowded; podetia short, verruculose throughout; cups large, entire or proliferous marginally, the proliferations generally with brown globular apothecia.

Common in our territory and cosmopolitan.

**4. *Cladonia pyxidata pocillum* (Ach.) Flot.**

Primary squamules larger than in the species, of more somber color, appressed; podetia short.

On earth; near San Diego, *Alderson* (communicated by Parish). Rare with us.

**5. *Cladonia pyxidata chlorophaea* (Spreng.) Floerke.**

Primary squamules less spreading than in the species, whitish or pale sulphur-colored, granulate-pulverulent; cups regular, rarely proliferous.



On earth, Santa Monica Range; Santa Catalina Island; cosmopolitan like the species.

**6. *Cladonia caespiticia* (Pers.) Floerke.**

Primary thallus squamulose-foliaceous, laciniate-lobed and obscurely crenate, light green or light yellowish green above, beneath white, pulverulent; squamules densely crowded forming small cushions, erect, KHO—,  $\text{Ca}(\text{ClO})_2$ —; podetia and spermogonia not seen.

On earth at base of cliffs; apparently rare.

**7. *Cladonia verticillata subcervicornis* Wain.**

Primary thallus persistent, olive green above, white beneath; podetia short, not over 1 cm. high, greenish gray to light brownish, somewhat granular or occasionally beset with several small squamules; cup flat or slightly concave, with brown apothecia on the rim, separate or conglomerate, sometimes elevated on a short pedicel, a few cups with a short indication of an axial prolongation, KHO+yellow,  $\text{Ca}(\text{ClO})_2$ —.

On earth under shrubs at San Diego.

**8. *Cladonia fimbriata simplex* (Weiss) Wain.**

Primary thallus thick; squamules medium-large, light gray green above, white beneath; podetia short, not longer than 15 to 17 mm., whitish, finely pulverulent; cups narrow, from 1 to 2 mm. wide at the rim; apothecia not seen, KHO—,  $\text{Ca}(\text{ClO})_2$ —.

On ground among moss, Santa Catalina Island, in the San Gabriel and Santa Monica Ranges, and also near San Diego.

**9. *Cladonia fimbriata subulata* (L.) Wain.**

Primary thallus scarce; squamules small, broadly spatulate or rounded, crenate, olive green above, white beneath; podetia from 1 to barely 2 cm. high, simple, cream color, finely pulverulent, squamulose, not cup-bearing, acuminate and pointed at the apex; sterile.

Earth and rotten wood, Santa Cruz Mountains, *Herre*; shaded earth in the Santa Monica Range.

**10. *Cladonia fimbriata clavata* Arnold.**

Primary thallus evanescent; podetia longer than in the preceding varieties (2.25 cm.), whitish, finely pulverulent, more or less bluntly clavate above.

On moss-covered boulders, Topanga Canyon, Santa Monica Range.

**11. *Cladonia pityrea* (Floerke) Fries.**

Squamules small, lobate, brownish above, whitish beneath; podetia from 5 to 10 mm. high, whitish or light grayish, finely pulverulent; cups narrow, the rim denticulate or often irregular and proliferous, the dentations and proliferations fertile; apothecia small, dark brown.

On earth; frequent and dispersed throughout the district.

## GYROPHORACEAE.

Thallus of one or several fronds, attached centrally to the substratum, the medullary layer containing *Pleurococcus* gonidia; apothecia appressed, sessile or subpedicellate, having a proper, mostly carbonaceous margin; disk gyrate furrowed, rarely smooth; asci 1 to 8-spored; spores colorless or dark, simple or several-celled or muriform.

### KEY TO GENERA.

- Spores simple, eight in asci..... GYROPHORA (p. 60).  
 Spores muriform-multilocular, one or two in the asci..... UMBILICARIA (p. 61).



**GYROPHORA** Ach.

Apothecia innate, sessile or almost pedicellate, circular, the proper margin dark, carbonaceous; disk commonly gyrose-plicate; paraphyses discrete; asci clavate or saccate-clavate; spores colorless, ellipsoid to oblong, simple; sterigma jointed; spermatia short, straight, cylindric.

## KEY TO SPECIES.

- Polyphyllous..... 2. *G. polyphylla*.  
 Monophyllous.  
   Ridged and rugulose above.  
     Frond without perforations..... 1. *G. rugifera*.  
     Frond with perforations.  
       Perforations numerous..... 4. *G. erosa*.  
       Perforations few..... 5. *G. torrefacta*.  
   Not ridged above.  
     Dark brown with a purple bloom..... 6. *G. angulata*.  
     Dark brown, bloom absent..... 3. *G. phaea*.

**1. *Gyrophora rugifera* (Nyl.) T. Fries.**

Monophyllous, rigid, 1 to 3 cm. wide, above deeply lacunose by prominent reticulated ridges, the surface finely areolate-granulose, yellowish brown at the center, becoming brown toward the border or brown throughout (a specimen from the Tehachapi Mountains with the upper surface turgidly rugose-plicate, of ash gray color with a delicate pale roseate tinge); beneath nearly of the same color as above but paler, the border crenulate and lobulate, neither cortex nor medulla affected by KHO, both turned red by  $\text{Ca}(\text{ClO})_2$ ; apothecia adnate-sessile, 0.25 to 1 mm. in diameter, grouped and crowded; disk black, obscurely gyrate, encircled by a more prominent gyration; epithecium brown, continuous; thecium  $80\ \mu$  high; paraphyses coherent; hypothecium dark reddish brown, as high as the thecium; spores ovoid, ellipsoid, and oblong-ellipsoid, 11 to  $15\ \mu$  long, 4 to  $6\ \mu$  thick.

On granitic rocks in the higher mountains; Mount San Antonio at 3,500 meters; San Bernardino and San Jacinto Mountains at 3,700 meters; Mount Cummings, Tehachapi Range, at 2,700 meters. Alpine. Northern Europe, Siberia.

**2. *Gyrophora polyphylla* (L.) Borr. & Turn.**

Monophyllous but oftener composed of a rosette of larger and smaller fronds, dark brown to black above, beneath smooth and in the center light brown gradually darkening toward the dull black periphery; border of the fronds entire to lacerate-crenate and lobed; apothecia innate and adnate, scattered or grouped, 0.25 to 1.5 mm. wide; disk black, gyrose, soon angular and lunette-shaped, a turgid, glistening gyration following the outline of the disk inclosing several thinner gyrations, KHO—,  $\text{Ca}(\text{ClO})_2$ +reddish or —; epithecium subcontinuous, dark brown; thecium  $112\ \mu$  high, colorless or tinted faint yellowish brown; paraphyses lax-coherent; hypothecium pale yellowish, nearly half the height of the thecium; asci inflated-clavate, the membrane stout; spores oblong ovoid ellipsoid, 12 to  $17\ \mu$  long, 6 to  $8\ \mu$  thick; hymenial gelatine with iodine dark reddish brown.

Sandstone, Devils Canyon, Santa Cruz Mountains, at 780 meters, *Herre*; Tehachapi Range at 1,500 meters.

**3. *Gyrophora phaea* (Tuck.) Herre, Proc. Washington Acad. Sci. 7: 366. 1906.**

*Umbilicaria phaea* Tuck. Lich. Calif. 15. 1866.

Monophyllous, dark brown and blackening above, smooth, beneath delicately granulose and at point of attachment radiately trabeculose, generally of lighter brown than above, though now and then dull black, from 0.5 to not over 2 mm. wide, the periphery entire to coarsely crenulate and lobulate, KHO,  $\text{Ca}(\text{ClO})_2$ ± red; apothecia



innate, on a level with or barely projecting above the surface of the frond, generally crowded near the border; disk black, gyrose-plicate, round or incurved-angled; epithecium continuous, brown; thecium dilute yellowish brown, 54 to 60  $\mu$  high; paraphyses coherent; hypothecium brown like the epithecium; asci inflated-clavate, 36 to 40  $\mu$  long, 18 to 20  $\mu$  thick; spores broadly ovoid, 10 to 16  $\mu$  long, 6 to 8  $\mu$  thick; hymenial gelatine pale blue with iodine.

Frequent in the mountains, ascending from the lower ranges. On granitic and other rocks in the Santa Monica and throughout the higher ranges of southern California. San Bernardino Mountains, *Parish*.

#### 4. *Gyrophora erosa* (Weber) Ach.

Monophyllous, rigid, brown above, delicately reticulate-rimose, the rimæ perforating the frond by numerous minute openings, the border crenate or finely erose, beneath lighter in color or darker and blackening, granulose, naked or a few fibrillæ toward the periphery, KHO—,  $\text{Ca}(\text{ClO})_2=$ , 2.5 to 5 cm. in diameter. The apothecia, spores, etc., do not differ from those of the next following species.

On rocks, Yosemite Valley, which is, so far as known, the southern limit in California. A lichen of arctic regions and the higher mountains of the northern United States; Europe; northern Asia.

#### 5. *Gyrophora torrefacta* Cromb.

Monophyllous, above a rich, dark reddish brown, less cribose and less erose at the periphery than *G. erosa*, thus appearing rather entire, the upper surface broadly turgid-rugulose, beneath brown black, coarsely papillate, often stoutly trabeculate, the fibrillæ less evident or wanting, KHO=,  $\text{Ca}(\text{ClO})_2\mp$ reddish; apothecia sessile, elevated, brittle; disk black, gyrose-plicate; epithecium subcontinuous, brown; thecium 44 to 48  $\mu$  high, pale yellowish brown; paraphyses adglutinated; hypothecium brown; asci clavate and inflated-clavate; spores ovoid, bluntly ellipsoid, 10.5 to 12  $\mu$  long, to 8  $\mu$  thick; hymenial gelatine blue with iodine.

On rocks growing with the last preceding species and easily confounded with it.

#### 6. *Gyrophora angulata* (Tuck.) Herre, Contr. U. S. Nat. Herb. 13: 318. 1911.

*Umbilicaria angulata* Tuck. Proc. Amer. Acad. 1: 266. 1847.

Monophyllous, smooth, black brown (in southern California) or with a purple bloom (from Siskiyou County), lobed and coarsely crenate at the periphery, from 1 to 2.5 cm. wide, beneath dark brown to dull black, areolate to coarsely papillate; apothecia innate to adnate, irregularly star-shaped to pluriangular; disk black, gyrose; epithecium subcontinuous, brown; thecium colorless or pale yellow tinted, about 70  $\mu$  high; paraphyses coherent; hypothecium brown, darker than the epithecium; asci clavate, 60  $\mu$  long, 15  $\mu$  thick; spores ovoid, 16 to 20  $\mu$  long, 8 to 10  $\mu$  thick; hymenial gelatine with iodine blue, with KHO violaceous, no change with  $\text{NO}_5$ . The color above and condition of thallus beneath varies, but the characteristic shape of the apothecia is constant.

On rocks; Siskiyou County, *Baker*; granite boulders at Tehachapi.

### UMBILICARIA Hoffm.

Spores muriform, colorless or decolorate, one or two in the asci.

#### 1. *Umbilicaria semitensis* Tuck.

Monophyllous, above uniform mouse-colored to brown, delicately rimose, the border involute, entire or lacerate-lobed, KHO=;  $\text{Ca}(\text{ClO})_2=$ ; KHO+ $(\text{CaClO})_2$ , the medulla faint red; apothecia adnate-sessile, 0.25 to 3 mm. in diameter, dispersed over outer part of frond; disk black, glistening, gyrate, round to obtusely angular, an entire or interrupted gyration encircling it; epithecium continuous, brown; thecium about 120  $\mu$  high, pale yellowish brown; paraphyses coherent; hypothecium brown; asci inflated-clavate to ventricose, about 100  $\mu$  long, 36  $\mu$  thick, the membrane thick throughout;



spores 8, ovoid and broadly ellipsoid, colorless to decolorate, 20 to 28  $\mu$  long, 14 to 20  $\mu$  thick; hymenial gelatine with iodine blue, the spores yellow.

On boulders near Tehachapi Station at 1,300 meters altitude; at Camp Baldy, San Antonio Canyon, in the San Gabriel Range at 1,500 meters.

### ACAROSPORACEAE.

Thallus crustaceous, squamous, or foliaceous, often scantily developed; gonidia Protococcus or Pleurococcus; apothecia imbedded in the thalline squamæ, sessile or subpedicellate; disk circular, often narrowed or irregular, lecideine, biatorine, or lecanorine; asci multisporeous; spores simple, commonly ellipsoid, rarely globular, colorless; spermatia oblong-ellipsoid, on a subsimple sterigma.

#### KEY TO GENERA.

- Apothecia with a proper margin, biatorine or lecideine... BIATORELLA (p. 62).  
Apothecia lecanorine..... ACAROSPORA (p. 63).

### BIATORELLA De Not.

Thallus crustaceous, uniform or subeffigurate at the circumference or obsolete; apothecia biatorine or lecideine, the proper margin devoid of thallus, with Pleurococcus gonidia, the apothecia innate, sessile or subpedicellate, circular.

#### KEY TO SPECIES.

- Substratum bark or wood..... 4. *B. moriformis*.  
Substratum rock.  
Thalluse effuse, indistinct..... 5. *B. hypophaea*.  
Thallus obsolete.  
Apothecia stipitate..... 3. *B. clavus*.  
Apothecia, sessile.  
Disk pruinose, black..... 1. *B. pruinosa*.  
Disk not pruinose, black..... 2. *B. simplex*.

#### 1. *Biatorella pruinosa* (J. E. Smith) Mudd.

Thallus obsolete or a few inconspicuous granules clustered around the apothecia; apothecia adnate, clustered or dispersed, 0.25 to 0.5 mm. in width; disk flat, dull black, pruinose (blackening when moist) with a permanent, thin, regular or wavy, concolorous margin; epithecium dark brown, continuous; thecium colorless, 56 to 60  $\mu$  high; paraphyses free, adglutinated only at the apices, scarcely thickened above, the tips pale brownish; hypothecium pallid amber yellow; asci oblong-ellipsoid, thickened above, about equaling the thecium in height; spores minute and numerous, 3 to 4  $\mu$  long, barely 1  $\mu$  thick; hymenial gelatine with iodine sordid greenish blue, the thecium and hypothecium blue and of darker shade than the thecium, the ascus wall not stained, but its contents yellow.

On quartzose and other rocks. Sandstone in the Santa Cruz Mountains, *Herre*; frequent on quartz in the Santa Monica Mountains; in the San Bernardino Mountains, *Parish*.

An epruinose state (forma *nuda* Nyl.) is found occasionally with the species, the apothecia barely or not at all pruinose, sessile, somewhat larger than in the species, the disk convex with a persistent, concolorous margin, the thecium 80 to 100  $\mu$  high, colorless, the spores 4 to 5  $\mu$  long, about 1  $\mu$  thick.

#### 2. *Biatorella simplex* (Davies) Branth & Rostr.

Thallus absent; apothecia sessile, 1 mm. or less wide, disk dark brown black, round or angular, turgid-papillate, surrounded by a concolorous, similarly turgid and inter-



rupted margin; epithecium continuous, yellowish brown, gradually paling downward; thecium colorless, 120 to 130  $\mu$  high; paraphyses slender, coherent, the slender brown tips scarcely thickened; hypothecium *pallid*, pale grayish yellowish, about as high as the thecium; asci oblong, thickened at top; spores minute and numerous, oblong-ellipsoid, 4 to 6  $\mu$  long, 1 to 1.5  $\mu$  thick; hymenial gelatine blue with iodine.

On various rocks in the Santa Monica and San Gabriel Ranges; at Del Mar on quartz pebbles. Europe; northern Africa; eastern Asia.

### 3. *Biatorella clavus* (Lam. & DC.) T. Fries.

Thallus absent; apothecia short-stipitate, large, from 1 to 3 mm. wide, dispersed or sometimes several congregated; disk flat, black (retaining that color when moistened), roughly papillate, naked; margin thick, persistent, crenate, following the sinuosities of the irregularly formed disk; epithecium continuous, orange to reddish brown, paling downward; thecium 160  $\mu$  high, colorless; paraphyses strict, subcoherent; hypothecium *brown*; asci inflated-clavate, the membrane thickened at apex; spores minute and numerous, oblong-ellipsoid, 3 to 4  $\mu$  long, 1 to 1.5  $\mu$  thick; asci with iodine staining a dilute claret red, the thecium and paraphyses reddish brown.

Frequent on rocks throughout our mountains. Eastern and southern United States; Europe.

### 4. *Biatorella moriformis* (Ach.) T. Fries.

Thallus indistinct and obsolete; apothecia small, sessile; disk planoconvex, dark brown and blackish, the margin entire, light colored; epithecium subcontinuous, light brown; thecium colorless, 68 to 80  $\mu$  high; paraphyses separate, not sharply defined, not or scarcely thickened at the tips; hypothecium colorless; asci pyriform or saccate, 60  $\mu$  long, 28 to 42  $\mu$  thick, including the quite thick membrane; spores spherical, numerous, small, 2 to 3.5  $\mu$  in diameter; hymenial gelatine with iodine blue, becoming sordid brown;  $\text{NO}_5$  changing the epithecium to yellow.

On bark of *Pseudotsuga macrocarpa*, Tehachapi Mountains near "Lone Pine Mine," at 1,600 meters. On *Aesculus californica* in Alameda County, Gray. Northeastern United States, north and west to Canada and Washington; Europe.

### 5. *Biatorella hypophaea* (Nyl.).

*Lecanora hypophaea* Nyl. Flora 53: 34. 1870.

Thallus effuse, indistinct, granular-pulverulent,  $\text{KHO}$ —,  $\text{Ca}(\text{ClO})_2$ —; apothecia sessile, 0.25 to 1 mm. wide; disk flat to lightly convex, faintly papillate, reddish black, mostly round, the margin permanent, entire or slightly wavy, somewhat shining; epithecium continuous, dark brown gradually paling downward, 30 to 32  $\mu$  high; thecium colorless, translucent 94 to 100  $\mu$  high, including the colored epithecium; paraphyses slender, strict, some clavate and colored at the tips; hypothecium pallid yellowish in the center, pale brown toward the circumference; asci oblong-ellipsoid; spores minute and numerous, oblong, apparently slightly thickened at both ends, 5 to 7  $\mu$  long, 1.5  $\mu$  thick; thecium staining brownish yellow with iodine, the asci brown.

On crumbling sandstone, Santa Monica Mountains.

## ACAROSPORA Mass.

Thallus crustaceous, radiate-squamulose, with some tendency to lobation at the periphery, rarely uniform; apothecia at first immersed, then sessile; disk round or now and then narrow and irregular, surrounded by a thalline margin containing *Protococcus* gonidia; spores simple, colorless, small and numerous; paraphyses unbranching, jointed; spermatia oblong-ellipsoid.



## KEY TO SPECIES.

Substratum earth.

Thallus of convex squamules.

Squamules brown, wrinkled..... 9. *A. obpallens*.

Squamules whitish, furfuraceous.

Spores globular or subglobular, 4 to 6  $\mu$  in diameter. 7. *A. pleistospora*.Spores globular or subglobular, 10 to 13  $\mu$  in diameter. 8. *A. pleiospora*.

Thallus squamules not convex, flat.

Greenish yellow..... 3. *A. schleicheri*.Whitish..... 6. *A. reagens*.

Substratum rock.

Squamules some shade of yellow.

Citrine yellow..... 1. *A. chlorophana*.Greenish yellow..... 2. *A. xanthophana*.

Squamules some color other than yellow.

Squamules brown.

Squamules wrinkled..... 9. *A. obpallens*.

Squamules not wrinkled.

Disk not punctiform, becoming dilated..... 12. *A. fuscata*.

Disk punctiform, immersed.

Squamules dark beneath..... 11. *A. rufescens*.Squamules pallid beneath..... 10. *A. squamulosa*.

Squamules light-colored.

Squamules ochroleucous.

Disk small, pruinose, the squamules flat..... 13. *A. aeruginosa*.Disk not pruinose, the squamules semiglobular 14. *A. glebosa*.

Squamules white or whitish.

Deeply fissured, ivory whitish..... 4. *A. peltasticta*.Not deeply fissured, more or less blackish  
suffused..... 5. *A. epilutescens*.**1. *Acarospora chlorophana* (Wahl.) Mass.**

Thallus citrine yellow, closely adherent to substratum by medullary hyphæ, rimose-areolate in the center, the areolæ flattened-globose, radiate at the circumference, turgid, contiguous, dilating outward and at the periphery deeply lobed, hypothallus indistinct,  $\text{KHO} =$ ,  $\text{Ca}(\text{ClO})_2 =$ ; apothecia immersed, from punctiform to 0.5 mm. wide; disk flat to convex, light gamboge yellow; proper margin hidden by the thalline margin; epithecium continuous, sulphur yellow; thecium colorless, 60 to 80  $\mu$  high; paraphyses lax-coherent, slightly thickened at the yellow tips, not jointed or branched; hypothecium colorless; asci inflated-clavate, membrane thickened at top, 60 to 80  $\mu$  long, 20 to 26  $\mu$  thick; spores numerous and minute, ellipsoid, 3 to 4.5  $\mu$  long, approximately 1 to 1.5  $\mu$  thick; hymenial gelatine with iodine blue, except the epithecium, this not stained.

Throughout the mountains of southern California above 1,600 meters altitude, on granite and gneiss; San Bernardino Mountains, *Parish*; San Gabriel and San Jacinto Mountains.

**2. *Acarospora xanthophana* (Nyl.) Fink, Contr. U. S. Nat. Herb. 14: 170. 1910.**

*Lecanora xanthophana* Nyl. Ann. Sci. Nat. IV. Bot. 15: 379. 1861.

Crust greenish yellow, closely adherent, of turgid, flattish squamules, discrete or contiguous, lobed, rounded or angular from juxtaposition, from 0.5 to 2 mm. wide; apothecia innate, generally single in the squamules; disk punctiform to enlarged, flat, sordid brownish and blackening, the thalline margin entire or crenulate; epithecium pale yellowish; thecium 120 to 140  $\mu$  high; paraphyses not or slightly thickened at the tips, not colored; hypothecium colorless; asci saccate, 120  $\mu$  long, 28  $\mu$  thick; spores minute and numerous, 4 to 6  $\mu$  long, 2  $\mu$  thick; hymenial gelatine with iodine pale blue.



On sandstone and rocks, Santa Cruz Mountains, *Herre*; San Bernardino Mountains, *Parish*; present in the Santa Monica Range, mostly at lower altitude than the last preceding species. Eastern and southern United States and throughout the Pacific Coast States; in the petrified forest of Arizona.

Form *dealbata* Tuck, with flat to convex white squamules and a black disk, occurs sparingly on argillaceous rocks in the Santa Monica Mountains.

**3. *Acarospora schleicheri* Mass.**

Crust of yellow or greenish yellow squamules, generally crowded, flat or rugose, lobate or coarsely crenate, forming round patches from 2 to 5 cm. in diameter, no reaction with KHO or  $\text{Ca}(\text{ClO})_2$ ; apothecia innate, 0.25 to 1 mm. wide; disk flat to barely convex, brownish black, papillate with a crenate thalline margin; epithecium continuous, yellowish brown; thecium 92  $\mu$  high, colorless or tinted faint yellow; paraphyses strict, coherent; asci inflated-clavate, 68 to 72  $\mu$  high, thickened at top; spores minute and numerous, globose, 3 to 4  $\mu$  in diameter; hymenial gelatine with iodine blue, turning brown.

On earth; Santa Monica and Verdugo Ranges at lower elevations; Point Loma near San Diego; Santa Catalina Island; Elsinore, Riverside County; San Bernardino, *Parish*. Western United States; Europe; northern Africa.

**4. *Acarospora peltasticta* Zahlbr. Beih. Bot. Centralbl. 13: 161. 1902.**

Thallus of round subglobular, dull ivory white squamules, 2 to 4 mm. wide, rimose-areolate, the areolæ angular, pyramidal or truncate, erect, no reaction with KHO or  $\text{Ca}(\text{ClO})_2$ ; apothecia one to several in a squamule, immersed, small, the disk black; epithecium continuous, light yellowish brown; thecium colorless, about 120  $\mu$  high; paraphyses slender, coherent and adglutinated at the apices and these scarcely thickened or colored; hypothecium yellowish; asci oblong-ellipsoid, about equaling the thecium in height, the membrane but little thickened above; spores small, numerous, spherical, oval or obovoid, 4 to 5  $\mu$  in diameter or 5  $\mu$  long, 3.5  $\mu$  thick; hymenial gelatine with iodine blue, the thecium sordid yellow green, the epithecium not affected by the reagent, the hypothecium staining persistently blue.

On crystalline rocks. San Nicolas Island, *Trask*; on granite at the base of the San Jacinto Mountains, near Palm Springs (the type locality); at Elsinore, Riverside County; Grand Canyon, Arizona.

Type deposited with Dr. A. Zahlbruckner; duplicate in herb. Hasse.

**5. *Acarospora epilutescens* Zahlbr. Beih. Bot. Centralbl. 13: 161. 1902.**

Thallus of turgid, semiglobose squamules, round or oblong, 1 to 2 mm. wide, contiguous or dispersed, whitish, ashy or light steel gray or light brown latterly, and white-suffused above, the squamules often marked by black fissures and short black ramifying or radiating capillary lines, giving the thallus to the naked eye a dark appearance, KHO—,  $\text{Ca}(\text{ClO})_2$ —; epithecium continuous, yellowish or brownish yellow to brown; thecium 120 to 170  $\mu$  high, colorless; paraphyses thin, loosely adglutinated, pale yellow and barely thickened at the tips; hypothecium colorless or very faint amber color, about one-quarter the height of the thecium; asci oblong-ellipsoid; spores minute and numerous, globular and ovoid, 3.5  $\mu$  long, 2.5 to 3  $\mu$  thick; hymenial gelatine with iodine blue, the thecium dark blue, the epithecium remaining unstained.

On granite. Type locality, Palm Springs at the eastern base of the San Jacinto Mountains.

Type deposited with Dr. A. Zahlbruckner; duplicate in herb. Hasse.

**6. *Acarospora reagens* Zahlbr. Beih. Bot. Centralbl. 13: 162. 1902.**

Thallus squamulose, white and white pruinose, lobed at the circumference, centrally rimose-areolate, turgid, KHO  $\pm$  brick red,  $\text{Ca}(\text{ClO})_2$  =, medullary hyphæ with iodine —; squamules discrete but often contiguous and forming white patches on the ground; apothecia round, one or more in a squamule, innate or slightly elevated



above the thallus, 1 to 1.5 mm. in diameter; disk flat, papillate, dark blackish red, when moistened dark brick red and the thallus gray, a raised, crenulate, thalline rim forming a spurious margin; epithecium continuous, brick red to brownish red, gradually paling downward; thecium pallid sordid yellowish, about 130  $\mu$  high; paraphyses adglutinated, coarse, not well defined, slightly thickened at the yellowish tips; hypothecium pale amber color; asci oblong-ellipsoid, reaching to the epithecium; spores numerous, globular, 5 to 6  $\mu$  thick; hymenial gelatine handsome blue with iodine, the epithecium remaining unchanged; with KHO no reaction.

On sandy earth near Palm Springs at eastern base of the San Jacinto Mountains (the type locality).

Type deposited with Dr. A. Zahlbruckner; duplicate in herb. Hasse.

**7. *Acarospora pleistospora* (Nyl.).**

*Lecanora pleistospora* Nyl.; Hasse, Bull. Torrey Club **24**: 446. 1897.

Thallus of sordid white to ash gray, entire, subglobular squamules, generally crowded, 1.5 to 1.75 mm. wide, the apex coarsely pruinose and forming a white somewhat coarctate thalline margin, the thallus KHO—,  $\text{Ca}(\text{ClO})_2$ —; apothecium solitary, immersed in the squamule, 0.3 to 0.75 mm. wide; disk concave, round, dark brown black; epithecium continuous, yellowish brown to brown; thecium colorless, 120 to 140  $\mu$  high; paraphyses slender, loosely coherent, not thickened at apices; hypothecium thin, pale amber color; asci ventricose, equaling the thecium in height; spores globular, numerous, 24 or more, 4 to 6  $\mu$  in diameter; hymenial gelatine with iodine blue, the yellowish epithecium remaining unchanged; no change with KHO.

On earth. Type locality, the foothills near the Soldiers' Home, Santa Monica; Verdugo Mountains, near Los Angeles.

Type deposited with Doctor Nylander; duplicate in herb. Hasse.

**8. *Acarospora pleiospora* (Nyl.).**

*Lecanora pleiospora* Nyl.; Hasse, Bull. Torrey Club **27**: 446. 1897.

Thallus crustaceous, of sordid white to light gray, round, subglobular squamules, dispersed, 1.5 to 1.75 mm. in width, with coarse scaly pruina, attached to substratum by medullary hyphæ, KHO—,  $\text{Ca}(\text{ClO})_2$ —; apothecia single in squamules, immersed, 0.3 to 0.75 mm. in width; disk concave, dark brown to black, the thalline margin somewhat coarctate; epithecium continuous, sordid yellowish; thecium 300  $\mu$  high, sordid pallid; paraphyses slender, subcoherent, containing numerous minute globules, conglutinated at the apices; hypothecium pale sordid yellow; asci saccate, 240  $\mu$  long, 48  $\mu$  thick; spores globular, 10 to 13  $\mu$  in diameter; hymenial gelatine with iodine blue, then reddish brown; spermogones not seen.

On earth. Type locality in the San Gabriel Range, at 700 meters altitude, along the "New Trail" to Mount Wilson. In external appearance this is very similar to the last preceding species, differing in the size of the spores.

Type deposited with Doctor Nylander; duplicates in the United States National Herbarium and in herb. Hasse.

**9. *Acarospora obpallens* (Nyl.) Zahlbr. Beih. Bot. Centralbl. **13**: 161. 1902.**

*Lecanora obpallens* Nyl. Act. Soc. Sci. Fenn. **26**: 31. 1890.

Thallus of discrete or crowded squamules, light chestnut, shining, slightly rugulose and pitted, convex, round, from 1 to 1.8 mm. wide; apothecia solitary in squamules, from primarily almost punctiform to 0.5 and 0.75 mm. in diameter; disk concave to flat, reddish brown, papillate, naked or slightly pruinose, with a thin, entire, persistent thalline margin; epithecium subcontinuous, pale yellowish brown to brown; thecium pallid; hypothecium pallid; paraphyses slender, coherent at the globular brown tips; asci inflated-clavate, extending up to the epithecium, the membrane thick, especially above; spores minute and numerous, oblong, 4 to 7  $\mu$  long, 1  $\mu$  or less than 2  $\mu$  thick; hymenial gelatin blue with iodine, turning vinous red, no change with KHO or  $\text{NO}_5$ .



On earth and crumbling sandstone. Type locality, foothills of the Santa Monica Range near the Soldiers' Home. Widely distributed in the State; Santa Cruz Peninsula, *Herre*; Santa Catalina Island; Mill Creek Canyon, San Bernardino Mountains; Palm Springs at foot of San Jacinto Mountains.

Type deposited in the U. S. National Herbarium; duplicates in the herbarium of New York Botanical Garden, with Dr. A. Zahlbruckner, and in herb. Hasse.

A parasite inhabits occasionally the thallus of *A. obpallens*. Small black, globular, sessile, erect bodies on the surface of the squamules, the perithecium dark brown black, parenchymatous, the inner membrane apparently colorless; asci obliquely lanceolate, 40 to 44  $\mu$  long, 14  $\mu$  thick; spores 8, colorless, bilocular, 11 to 12  $\mu$  long, 3.5 to 4  $\mu$  thick; paraphyses absent.

**10. *Acarospora squamulosa* (Schrad.) T. Fries.**

Crustaceous, brown, of flat or convex, rounded and sublobulate or entire, crowded or dispersed squamules, beneath whitish, KHO—,  $\text{Ca}(\text{ClO})_2$ —; apothecia impressed, small; disk flat, black, with a thick, entire thalline margin; epithecium continuous, light brown; thecium 120  $\mu$  high; paraphyses separate or loosely coherent, not thickened nor colored at the tips, simple, entire; hypothecium colorless, equaling the thecium in height; asci saccate, 100  $\mu$  long, 24  $\mu$  thick; spores very minute and numerous; hymenial gelatine blue then brown with iodine.

On various rocks. Frequent in the Santa Monica Range.

**11. *Acarospora rufescens* (J. E. Smith) T. Fries.**

Thallus of light or dark chestnut brown squamules, these crowded and imbricated or more dispersed, wavy and lobate in outline, undulate, not closely adnate to the substratum, somewhat shining, *beneath black*, no reaction with KHO or  $\text{Ca}(\text{ClO})_2$ ; apothecia immersed, small, flat to at last larger and concave, reddish brown; epithecium continuous, pale straw color; thecium colorless, about 120  $\mu$  high; paraphyses stout, about 2  $\mu$  thick, loosely coherent, entire, simple, not or but slightly thickened at apices and finally tinted pale yellow; hypothecium colorless or with a faint yellow tint and equaling the thecium in height; asci inflated-clavate, 100 to 116  $\mu$  long, 26 to 28  $\mu$  thick, membrane much thickened at upper part; spores very minute and numerous, oblong, 3 to 4  $\mu$  long, 1  $\mu$  thick; hymenial gelatine pale blue, the hypothecium darker and the ascus contents greenish yellow with iodine.

On granite, San Bernardino Mountains at 3,000 meters altitude; Santa Cruz Mountains, *Herre*.

**12. *Acarospora fuscata* (Schrad.) Arnold.**

Thallus crustaceous, dark brown, rimose-areolate, beneath dark; apothecia innate; disk primarily small, at last enlarging and occupying nearly the entire areole, from concave to flat and level with the thallus, dark brown; epithecium yellowish brown to brown, continuous; thecium 92 to 96  $\mu$  high, colorless; paraphyses moderately stout, loose but adglutinate at the tips, these scarcely thickened, yellowish brown; hypothecium pale amber color; asci inflated-clavate, the membrane thickened above, nearly reaching the epithecium; spores very minute and numerous; hymenial gelatine with iodine blue, the epithecium remaining unstained; thecium soon greenish blue, the hypothecium persistently blue.

On rocks. From various localities in the Santa Cruz Peninsula, *Herre*; on sandstone in the Santa Monica Range. Arctic America and northern United States; Europe.

**13. *Acarospora aeruginosa* Hasse, sp. nov.**

Thallus squamulose, the squamules flattened-convex, contiguous or dispersed, clay-colored, 0.25 to 0.5 mm. wide, KHO ( $\text{Ca}(\text{ClO})_2$ )—, semitranslucent when moist; apothecia central, immersed; disk depressed, flat, pale greenish or pale bluish pruinose, about 0.1 to 0.15 mm. wide; epithecium granulose, colorless; paraphyses capillary,



simple, entire, loose, not thickened above; hypothecium colorless; thecium 140 to 150  $\mu$  high, colorless; asci inflated-clavate, the membrane thin without thickening of the upper part, about equaling the thecium in height; spores minute, numerous, oblong, 3 to 4  $\mu$  long, barely 1  $\mu$  thick; hymenial gelatine with iodine blue throughout, darkest at upper part.

On argillaceous shale, Santa Monica Range. Type locality, foothills near the Soldiers' Home.

Type deposited in herb. Hasse.

#### 14. *Acarospora glebosa* Koerb.

Thallus of round, reddish brown, convex squamules not exceeding 1 mm. in width, scattered or approximate, the squamules in the latter case becoming angular and rimose; apothecia small, punctiform, depressed, generally single, rarely two in a squamule, the disk at last slightly enlarged and concave, dull black with a rim of thalline margin; epithecium continuous, dark reddish brown; thecium colorless, about 120  $\mu$  high, stained blue with iodine, particularly the hypothecium being dark blue, the epithecium showing no reaction; paraphyses moderately stout, loosely coherent but adglutinated at the tips; hypothecium colorless; asci ventricose, the membrane thickened at the top, 100  $\mu$  long, 36  $\mu$  thick; spores 24 in each ascus, bluntly ellipsoid, 11 to 18  $\mu$  long, 5 to 8  $\mu$  thick; Protococcus gonidia forming a thick sub-cortical layer extending also under the hypothecium.

On sandstone, Santa Monica Range. Outwardly very similar to a *Heppia*.

### PYRENOPSISIDACEAE.

Thallus crustaceous (in our species), dark, dull black; apothecia urceolate or expanded; parathecium and hypothecium well developed or obsolete; paraphyses gelatinous, not branched nor jointed; asci 8 to many-spored; spores colorless, ovoid-ellipsoid to globular, simple, rarely bilocular; spermatia ovoid, oblong to acicular, straight or curved.

Of the genera classed with this family we have only the following:

#### PSOROTICHIA Mass.

Crust granular-areolate; gonidia consisting of *Xanthocapsa* algæ, the cells round, blue green, clothed with a yellowish to yellow brown gelatine; apothecia immersed and urceolate, finally opening, furnished with a proper and a lecanorine margin; paraphyses few, slender, adglutinated or separate; asci 8-spored, exceptionally 4 to 32-spored; spermatia oblong-ellipsoid.

#### KEY TO SPECIES.

Growing on earth.

Contiguous squamules forming green black patches..... 1. *P. segregata*.

Growing on rock.

Squamulose; squamules lobate, forming small green cushions. 3. *P. squamulosa*.

Not squamulose.

Forming coralloid black patches..... 2. *P. arnoldiana*.

Crustaceous.

Green black, areolate-rimose..... 4. *P. schaereri*.

Dark brown, coarsely granulose..... 5. *P. phaeococca*.

#### 1. *Psorotichia segregata* (Nyl.).

*Collemopsis segregata* Nyl.; Hasse, Lich. South. Calif. 6. 1898.

Crustaceous thallus blackish green, the small patches not over 1 cm. in diameter, without rhizinae, homogeneous with submoniliform blue green gonidia; the thallus almost entirely covered by the apothecia, these 0.2 mm. wide, at first urceolate with



turgid thalline margin, the disk finally immarginate, planoconvex, dull reddish; epithelial structure absent, replaced by the free apices of the slender, loose, adglutinate paraphyses; thecium colorless, 132 to 140  $\mu$  high; hypothecium amber color, about 40  $\mu$  high; asci oblong-cylindric, nearly of the height of the paraphyses; spores 8, oblong-ellipsoid, 16 to 18  $\mu$  long, 10 to 11  $\mu$  thick; hymenial gelatine with iodine a sordid pale blue, the pale yellow stained apices of the paraphyses protruding above the epithecium; sterigma simple, straight; spermatia small, oval, about 2  $\mu$  long, and less than 1  $\mu$  thick.

On earth, foothills of the Santa Monica Range near the Soldiers' Home, the type locality.

**2. *Psorotichia arnoldiana* (Hepp) Koerb.**

Crust blackish, thin, coralloid-crustaceous, loosely attached without true rhizinæ, forming small patches about 1 cm. in diameter; gonidia blue green, round or oval, 4 to 12  $\mu$  in diameter, the larger irregular or ovoid, scattered; apothecia numerous, small, globular, urceolate; epithelial structure indistinct; thecium colorless, 100 to 140  $\mu$  high; paraphyses slender, loose, imbedded in hymenial gelatine, their apices free, not thickened nor colored; hypothecium pallid; asci cylindric and oblong-cylindric, about half the height of the thecium; spores 8, simple, oblong or obovate-ellipsoid, 15 to 24  $\mu$  long, 9 to 12  $\mu$  thick; hymenial gelatine with iodine blue, turning brown.

Among moss on soft disintegrating sandstone in the Strawberry Valley, San Jacinto Mountains, at 1,650 meters altitude.

**3. *Psorotichia squamulosa* Zahlbr. Beih. Bot. Centralbl. 13: 158. 1902.**

Thallus of dull black or dark olive green, cartilaginous, round-lobate squamules, forming small cushions; apothecia minute, immersed in thalline warts; disk concave, brown; paraphyses imbedded in hymenial gelatine, reddish brown and hardly thickened above; asci tubular, about 80  $\mu$  long; spores 16 in asci, ellipsoid, simple, 9 to 12  $\mu$  long, 5 to 6  $\mu$  thick; hymenial gelatine light blue with iodine turning yellow; hypothecium brownish yellow.

In crevices of disintegrating granite at Palm Springs, the type locality. Type in the hands of Dr. A. Zahlbruckner; duplicate in herb. Hasse.

**4. *Psorotichia schaeereri* (Mass.) Arnold.**

Thallus almost black, forming an areolate-rimose or areolate-diffract, coarsely granular to coralloid, thin crust; apothecia numerous, from quite small to at length 0.5 to 0.8 mm. wide, sessile; disk at first immersed, finally flat, round, black, slightly papillate, with a persistent, crenulate, concolorous proper margin, the apothecia and thallus forming a black crust to the unaided eye; epithecium continuous, pale brownish yellow, gradually fading downward; thecium 80 to 100  $\mu$  high, in places colorless but mostly yellowish brown of the same hue as or darker than the epithecium; paraphyses adglutinate, slightly clavate at the tips; hypothecium golden or orange brown, about half the height of the thecium; asci clavate and inflated-clavate, about equaling the thecium in height; spores 8, oblong-ellipsoid, simple, colorless, 12 to 18  $\mu$  long, 7 to 9  $\mu$  thick; hymenial gelatine with iodine blue, the hypothecium darker than the thecium, the epithecium not changed by the reagent; gonimia all light blue green with a thin membrane and without a gelatinous capsule, round or ovoid, 4 to 8  $\mu$  in diameter, sometimes two joined at the flattened sides, 8 to 12  $\mu$  in diameter, or even four cohering, scattered.

On sandstone and argillaceous shale in the Santa Monica Range.

**5. *Psorotichia phaeococca* (Tuck.).**

*Synalissa phaeococca* Tuck. Gen. Lich. 80. 1872.

Thallus a coarsely granular, black brown crust, the granules separate or contiguous; apothecia numerous, small, globular, sessile, 0.2 to 0.5 mm. in diameter; disk sordid brick red, at first impressed, then larger, concave, with an entire proper margin concolorous with the disk; epithecium continuous, yellow; thecium 120  $\mu$  high, colorless,



with iodine blue; paraphyses coherent, simple, entire, not clavate nor colored at the tips; hypothecium paler yellow than the epithecium, about  $60\ \mu$  high, asci inflated-clavate, equaling the thecium in height, the membrane thickened above; spores broadly ovoid-ellipsoid, 19 to  $21\ \mu$  long,  $12\ \mu$  thick, indistinctly bilocular; septation plainer after KHO, the spore then sometimes trilocular.

Sandstone, Santa Monica Range.

### EPHEBACEAE.

Thallus dwarf-fruticulose, terete and closely branching or foliaceous; symbionts *Scytonema* or *Stigonema* algæ. In our district represented only by one genus of the several classed here by authors.

### POLYCHIDIUM Ach.

Thallus foliaceous, deeply lobate and incised, appressed or ascending, or fruticulose with terete ramifications, naked or ciliolate; gonidia concatenate, consisting of *Scytonema* algæ; apothecia sessile, biatorine, red-brown, the disk flat to convex; paraphyses not branched, coherent and thickened at the tips; asci clavate, 8-spored, the spores fusiform-oblong, bilocular; spermatia short, cylindric.

#### KEY TO SPECIES.

- |                          |                             |
|--------------------------|-----------------------------|
| Thallus foliaceous.....  | 1. <i>P. albociliatum</i> . |
| Thallus fruticulose..... | 2. <i>P. muscicola</i> .    |

1. *Polychidium albociliatum* (Desmaz.) Zahlbr. in Engl. & Prantl, Nat. Pflanzenfam. 1<sup>1\*</sup>: 157. 1907.

*Leptogium albociliatum* Desmaz. Ann. Sci. Nat. IV. Bot. 4: 132. 1855.

Thallus foliaceous, olive green, elongate; lobed border of thallus crenate, finely lacinate and fringed with a row of short white ciliæ extending onto the under surface; apothecia sessile, 0.5 to 1 mm. wide, disk flat or slightly convex, brownish red, with an entire, indistinct, lighter colored margin; epithecium continuous, faint yellow, gradually paling downward; thecium 72 to  $100\ \mu$  high, colorless or faintly tinted similar to the epithecium; paraphyses adglutinated, somewhat thickened and some of them colored at the tips; hypothecium about half the height of the thecium and in color like the epithecium; asci inflated-clavate and ventricose,  $80\ \mu$  high,  $24\ \mu$  thick, the upper part of membrane thickened; spores broadly fusiform, bilocular, colorless, acuminate at both ends, 20 to  $24\ \mu$  long, 7 to  $9\ \mu$  thick; hymenial gelatine with iodine blue, soon sordid brownish yellow.

Among mosses on rocks or on the ground, in the Santa Monica and San Gabriel Ranges. Europe.

2. *Polychidium muscicola* (Swartz) S. F. Gray.

Thallus fruticulose, terete, shining, dark brown and blackening toward the apices, ramifying dichotomously and trichotomously, intertangled, 3 to 4 mm. high, a transverse section giving a cortical layer of large, oblong-ovoid cells, 10 to  $12\ \mu$  long, 6 to  $8\ \mu$  thick; under this layer the gonidial layer of blue green algæ, these 7 to  $10\ \mu$  in diameter, in the axis coarse longitudinal hyphæ; spermogones not seen; apothecia comparatively large, adnate, 0.25 to 1 mm. in diameter; disk concave, brown, the margin of the same color, erect, entire; epithecium light yellowish brown, subcontinuous; thecium colorless to pallid yellowish, 100 to  $108\ \mu$  high; paraphyses adglutinated; hypothecium colored similarly with the epithecium and about equaling the thecium in height; asci inflated-clavate or saccate; spores 6 to 8 in asci, oblong-fusiform, bilocular, a large oil globule in each loculus, acute or acuminate-blunt at each end, 24 to  $30\ \mu$  long, 7 to  $8\ \mu$  thick; hymenial gelatine with iodine blue except the epithecium, this retaining its natural color.

On sandstone, Topanga Canyon, Santa Monica Range.



## COLLEMACEAE.

Thallus gelatinous, crustaceous-foliaceous, squamulose or minutely fruticulose, homoömerous, with blue green Nostoc algæ; apothecia immersed in the thallus, close-fruited or open-fruited, or adnate-sessile, mostly lecanorine, rarely biatorine, with or without a proper parathecium and hypothecium (excipulum); disk punctiform or expanded; asci 8-spored; spores colorless, globular or acicular, simple, bilocular to several-locular or muriform.

In our species, apothecia lecanorine, spores bilocular to muriform.

## KEY TO GENERA.

- Thallus ecorticate..... COLLEMA (p. 71).  
 Thallus corticate on one or both surfaces ..... LEPTOGIUM (p. 73).

## COLLEMA (Hiller) Weber.

Thallus foliaceous, macrophylline to microphylline, sometimes almost crustaceous, gelatinous when moist; apothecia circular, innate to adnate-sessile, lecanorine; proper exciple present or wanting.

## KEY TO SPECIES.

- Lobes of thallus large, rugulose.  
   Beset with granulations..... 2. *C. aggregatum*.  
   Not beset with granulations.  
     Apothecia dull reddish, naked..... 1. *C. nigrescens*.  
     Apothecia bluish pruinose..... 3. *C. glaucophthalmum*.  
 Lobes small.  
   Growing on a mineral substratum.  
     On rock.  
       Lobes turgid..... 7. *C. pulposum*.  
       Lobes not turgid..... 6. *C. cheileum*.  
     On earth.  
       Lobes thin, appressed..... 8. *C. limosum*.  
       Lobes suberect, clavate..... 5. *C. coccophorum*.  
   Growing on bark.  
     Lobes erect, fasciculate.  
       Spores fusiform..... 4. *C. fasciculare*.  
       Spores rounded-quadrangular..... 9. *C. verruciforme*.

1. *Collema nigrescens* (Leers) Wain.

Thallus foliaceous, black green, round-lobed, flattened, closely adherent, radiate-rugulose, lacunose beneath; apothecia sessile or elevated, 0.5 to 0.75 mm. in diameter; disk flat, red brown with a thin thalline margin, this finally obscured; epithecium subcontinuous, brown, thin; thecium colorless, 80 to 96  $\mu$  high; paraphyses coherent, strict; hypothecium pallid amber yellow; asci clavate, nearly equaling the thecium in height; spores fusiform, 6 to 8-locular, 60 to 68  $\mu$  long, 5 to 6  $\mu$  thick; hymenial gelatine with iodine blue; spermatia short, straight, 4 to 7  $\mu$  long, 1 to 1.5  $\mu$  thick.

On various barks in the Santa Monica Range and on slate rocks, on which substratum it is generally sterile.

2. *Collema aggregatum* (Ach.) Nyl.

Thallus black green, foliaceous, orbicular, 2 to 4 cm. in diameter, round-lobed, entire or with short marginal ciliæ, the upper surface irregularly rugose and beset with granulations, closely adherent except toward the ascending margins, somewhat paler beneath, lacunose and fenestrate; apothecia elevated-sessile; disk flat, at first delicately pruinose, later naked, reddish to almost concolorous with the thallus, the



thalline margin persistent and entire or also beset with fine thalline granulations; epithecium subgranulose, pale sordid yellowish; thecium 100 to 120  $\mu$  high, colorless; paraphyses adglutinated; hypothecium sordid yellowish, lighter than the epithecium, 20 to 25  $\mu$  high; asci subinflated-clavate; spores fusiform, 6-locular, 36 to 60  $\mu$  long, 5  $\mu$  thick.

On rocks, Santa Monica Range.

### 3. *Collema glaucophthalmum* Nyl.

Thallus black green, closely adhering except the ascendant, entire margins, undulate, deeply round-lobed, the upper surface rugulose and tuberculate, beneath lacunose and somewhat paler; apothecia generally numerous, sessile to elevated, 0.25 to 0.75 mm. wide; disk flat, soon convex and the at first thin regular margin disappearing, the pruina giving a purplish or whitish bloom to the disk; epithecium subcontinuous, yellowish brown; thecium 84 to 92  $\mu$  high, colorless to pale amber; paraphyses adglutinated, strict, hardly thickened at apices; hypothecium amber color, about 40  $\mu$  high; spores long fusiform, plurilocular, 40 to 56  $\mu$  long, 4 to 5  $\mu$  thick; septa faint but more numerous than in the last preceding species; asci clavate, nearly as high as the thecium; hymenial gelatine blue with iodine.

On bark of oaks in canyons of the Santa Monica and San Gabriel Ranges.

### 4. *Collema fasciculare* Ach.

Thallus blackish green, forming small orbicular cushions 2 to 3 cm. in diameter, composed of erect, clavate or dilate-fanshaped fascicles 1 to 1.25 mm. high; apothecia numerous, sessile, one to several on the upper border of the lobule; disk primarily flat, then strongly convex, dull reddish, when moist of a light brick red, the thalline margin entire or crenulate; epithecium continuous, reddish brown, gradually paling downward; thecium 60  $\mu$  high, colorless, toward the circumference pale reddish; paraphyses adglutinate, slightly clavate at the colorless tips; asci clavate; hypothecium pallid, about equaling the thecium in height; spores 8, fusiform, mostly 4-locular, with globules in the cells, 18 to 26  $\mu$  long, 6 to 7  $\mu$  thick, outlines of the spores inclined to be unsymmetrical; hymenial gelatine with iodine blue.

On barks, Santa Monica Range.

### 5. *Collema coccophorum* Tuck.

Thallus black, forming patches 2 to 3.5 cm. wide, composed of small, aggregated, clavate lobules, 1.5 to 2 mm. high, coalescing toward the periphery in thin flat lobes 2 to 3 mm. wide with entire border, the upper surface beset with stout granules, the pedicellate lobules and flat lobes adhering to the substrate by a few slender rhizinae; apothecia subsessile or innate; disk reddish black, at first concave, then flat, the thalline margin crenate; epithecium continuous, dark reddish brown; thecium 68 to 100  $\mu$  high, colorless; paraphyses coherent; hypothecium colorless or pale amber; asci clavate, 60  $\mu$  long, 15  $\mu$  thick; spores 8, ovoid-ellipsoid, bilocular, slightly constricted, one end acuminate, 20  $\mu$  to 24  $\mu$  long, 7 to 9  $\mu$  thick, the loculi with oil globules; with iodine the asci stained blue, the paraphyses yellow, the hypothecium not changed.

On earth near Murietta Hot Springs; at Palm Springs and Topanga Canyon of the Santa Monica Range.

### 6. *Collema cheileum* Ach.

Thallus greenish black, foliaceous, lobes small, loosely imbricated, about 1 mm. wide, round, entire, undulate-plicate, and toward the base of lobule warty; apothecia innate, one in a lobule; disk reddish, flat with an at first erect thalline margin, entire or crenulate, or with minute round lobules; epithecium subentire, handsome dark brown; thecium 136 to 152  $\mu$  high, colorless; paraphyses loosely coherent, simple, entire, not thickened nor colored at the tips; hypothecium very faintly colored,



about two-thirds the height of the thecium; asci saccate, 126 to 130  $\mu$  high, thickened at top; spores 8, oblong ovoid ellipsoid, 4-locular and submuriform, 24 to 32  $\mu$  long, 16 to 20  $\mu$  thick; hymenial gelatine with iodine a handsome blue extending into the hypothecium, the spores pale yellow.

Frequent on sandstone in the Santa Monica Range.

The form *monocarpum* Nyl. occurs in the same locality, though less frequent; the thalline lobes are dispersed, small, and almost entirely covered by the solitary apothecium.

**7. *Collema pulposum* (Bernh.) Ach.**

Thallus hard, brittle when dry, when moist leathery and gelatinous, blackish green, orbicular, the prostrate lobes of the periphery becoming ascending toward the center, the lobes turgid, more or less deeply crenate at the margin and plicate; apothecia quite numerous, subinnate or appressed, 1 to 2 mm. in width; disk brick red, flat or convex, the thalline margin persistent, thick, crenulate; epithecium pale yellowish, gradually paling downward, subcontinuous; thecium 92 to 108  $\mu$  high, colorless; paraphyses adglutinate; hypothecium yellowish, darker than the epithecium; asci inflated-clavate; spores ovoid-ellipsoid, submuriform, 16 to 32  $\mu$  long, 8 to 16  $\mu$  thick, 4 or 5-locular, the central loculi again septate in the long axis of the spore.

In the Santa Monica Range on earth among mosses and on decaying granite.

**8. *Collema limosum* Ach.**

Thallus dark olive green, appressed or excentrally ascendent, the small lobes entire or crenulate, mostly approximate, hardly 0.5 cm. wide; apothecia appressed, flat to planoconvex, from 1 to 2.75 mm. in diameter, brick red and darkening, the thalline margin thick, entire or crenulate; epithecium subcontinuous, rich yellow, thicker and darker toward the circumference; thecium colorless, 100  $\mu$  high; paraphyses coherent; hypothecium about half the height of the thecium, of similar color and likewise darkening at the circumference; asci ventricose, equaling the thecium in height; spores obovoid-ellipsoid, 4-locular and submuriform, 22 to 30  $\mu$  long, 9 to 12  $\mu$  thick; hymenial gelatine blue with iodine, the spores yellow.

On earth in the Santa Monica Range. Southern United States; Europe; Asia (China).

**9. *Collema verruciforme* (Ach.) Nyl.**

Thallus dark brown, forming small patches of ascending clusters of broadly club-shaped, and toward the tops flattened and lobulate, lobules, about 2 to 3 mm. high; apothecia numerous, sometimes 3 or 4 on a lobule, sessile, 0.2 to 0.5 mm. in diameter; disk at first concave, then flat, dark red, when moistened of a bright blood red with a lighter colored, entire proper margin; epithecium continuous, chocolate brown; thecium 112 to 118  $\mu$  high, colorless; asci clavate to inflated-clavate, 64 to 80  $\mu$  long, 24 to 32  $\mu$  thick, the membrane thickened above; spores 4-locular, 16 to 22  $\mu$  long, 12  $\mu$  thick, quadrangular in shape with rounded angles, the loculi with oil globules; hymenial gelatine with iodine blue, the spores pale straw color; spermatia minute, oblong, 3 to 4  $\mu$  long, barely 1  $\mu$  thick.

On decayed oak wood in the Yosemite Valley. It may extend to our territory.

**LEPTOGIUM (Ach.) S. F. Gray.**

Thallus membranaceous, crustaceous-granulose and lobed at the periphery, foliaceous or fruticulose, the upper or both surfaces pseudoparenchymatous-corticate; gonidia moniliform, consisting of Nostoc; apothecia innate to sessile, lecanorine, the disk circular, the margin containing gonidia; asci 8-spored, the spores colorless, fusiform, 4 to several-locular and to muriform; spermatia small, ovoid or cylindric, straight.



## KEY TO SPECIES.

- Substratum bark; lobes ascending, foliaceous, the upper surface  
 beset with lobules..... 2. *L. burgessii*.  
 Substratum rock and earth.  
 Thallus crustaceous-granulose..... 7. *L. rhyparodes*.  
 Not crustaceous.  
 Lobulate.  
 Lobes club-shaped..... 1. *L. plicatile*.  
 Lobes not club-shaped.  
 Foliaceous.  
 Minute..... 5. *L. tenuissimum*.  
 Larger.  
 Palmately lobed..... 6. *L. palmatum*.  
 Not palmately lobed.  
 Laciniate-lobed..... 3. *L. californicum*.  
 Deeply lacero-laciniate..... 4. *L. lacerum*.

**1. *Leptogium plicatile* (Ach.) Nyl.**

Thallus small, orbicular, cartilaginous, deeply lobed, the narrow central lobes ascending; apothecia sessile at the apices of the crowded lobes; disk dull brownish, remaining long concave, the proper margin entire, thick, somewhat lighter colored; epithecium amber color, gradually paling downward; thecium colorless, about  $140\ \mu$  high; paraphyses adglutinated; hypothecium dull yellow brown, darker than the epithecium; asci oblong-cylindric, about equaling the thecium in height; spores ovoid-ellipsoid, submuriform, 4-locular with several longitudinal septations of the loculi, 16 to  $32\ \mu$  long, 8 to  $14\ \mu$  thick; hymenial gelatine deep blue with iodine.

Thallus with a small-celled pseudoparenchymatous cortex, and the medullary hyphæ narrow.

On calcareous tufa in the Santa Monica Range.

**2. *Leptogium burgessii* (Lightf.) Mont.**

Thallus forming purplish brown cushions from 1 to 2 cm. wide, foliaceous and lobed, the lobes imbricated, rounded and sinuate, the upper surface closely beset with erect, oblong lobules, the lower intricately rugulose, pale; apothecia minute, 1 to 1.5 mm. wide, surrounded by a laciniate thalline margin; disk concave, with an entire proper margin, both concolorous with the thallus; thecium  $140$  to  $180\ \mu$  high; asci oblong-cylindric,  $120\ \mu$  long, 16 to  $18\ \mu$  thick; spores ellipsoid, apiculate at each end, muriform,  $32\ \mu$  long,  $16\ \mu$  thick.

On bark. Collected in Lower California by T. S. Brandege and deposited in the Herbarium of the California Academy of Sciences at San Francisco. Previous to the destruction of that herbarium by the catastrophe of April 18, 1906, the writer, through the kindness of the curator, Miss Alice Eastwood, was given the opportunity of examining the lichens of the Academy, and from a fragment retained by permission this description is taken. The species may be found in our district.

**3. *Leptogium californicum* Tuck.**

Thallus dark brown, sinuate, laciniate-lobed, the lobes from 1 to 1.5 cm. in length, short and imbricated in the center, the lobules more coarsely lacerated than in *L. palmatum*, the upper and lower surfaces finely reticulate-wrinkled; apothecia sessile, small, 0.2 to 0.75 mm. wide, the disk convex and with the entire margin concolorous with the thallus; epithecium colorless; thecium colorless, about  $140\ \mu$  high; paraphyses septate, simple, entire, clavate at the tips; hypothecium colorless, thin; spores 6-locular, ellipsoid and submuriform, 24 to  $44\ \mu$  long, 7 to  $13\ \mu$  thick.

Among moss on rocks, near Mayfield, *Herre*; Santa Monica and San Gabriel Ranges and doubtless throughout the State.



Two forms are recognized: Forma *platynum* of authors, with irregular and larger lobes (up to 4 cm. long), finely wrinkled and tuberculate, the color, in the herbarium, quite leaden gray, the spores 40 by 16  $\mu$ —on earth above Saratoga, California, *Herre*; and forma *lophatum* of authors, the lobes finely and deeply dissected, the thallus dark chestnut brown and glistening, the tips of the laciniae granular-thickened—forming dense cushions among moss, Mount Wilson of the San Gabriel Range, at 1,650 meters; Yosemite Valley at a like elevation.

**4. *Lepotogium lacerum* (Retz) S. F. Gray.**

Thallus foliaceous, brown, becoming grayish brown in the herbarium, the lobes densely intricate, deeply and narrowly lacero-laciniate, forming cushions; apothecia elevated-sessile, about 0.75 mm. in diameter; disk concave, with the entire, smooth margin light reddish; epithecium subgranulose, yellowish greenish brown; thecium about 140  $\mu$  high, colorless; paraphyses strict, slender, loosely coherent; hypothecium almost colorless; asci cylindric, about equaling the thecium in height; spores oblong-ellipsoid, one end long-attenuate, muriform, 28 to 44  $\mu$  long, 10 to 16  $\mu$  thick; hymenial gelatine with iodine deep blue, the spores yellow.

On the ground running over moss; Mill Creek Canyon, San Bernardino Range at 1,700 meters. Throughout North America; South America (Chile); Europe.

**5. *Leptogium tenuissimum* (J. E. Smith) Koerb.**

Thallus minute, brown, of laciniate, small, foliaceous squamules; apothecia sessile, from 0.2 to 0.75 mm. in diameter; disk at first immersed, urceolate, with a turgid margin, to finally flat, dull reddish, the margin thinner and lighter colored than the disk; spores oblong-ellipsoid, 5-locular with several of the loculi subdivided in the longitudinal axis, 32 to 36  $\mu$  long, 12 to 16  $\mu$  thick.

On sandstone, Santa Monica Range; Santa Cruz Mountains at 1,700 meters altitude, *Herre*.

**6. *Leptogium palmatum* (Huds.) Mont.**

Thallus dark brown, becoming grayish brown, palmate-lobate, the lobes irregularly lacerate and convolute, appearing corniculate; apothecia small, 0.25 to 0.33 mm. in diameter, appressed; disk concave, brick red, the entire margin paler; epithecium continuous, pale brownish yellow; thecium 180  $\mu$  high, colorless; paraphyses not thickened above, distinct; hypothecium colorless; asci clavate, about 150  $\mu$  high, spores broadly ellipsoid and ovoid-ellipsoid, 4-locular and submuriform, 18 to 36  $\mu$  long, 12 to 20  $\mu$  thick.

On earth among moss; Santa Cruz Peninsula, *Herre*; at Santa Barbara; Santa Monica Range. Pacific Coast States. Europe.

**7. *Leptogium rhyarodes* Nyl.**

Thallus thin, coarsely and unequally granulate-crustaceous, brown to darkening; apothecia small, at first concave, the disk dull brick red, the elevated, entire margin of lighter color, later flat and biatorine; epithecium pallid, granulose; thecium about 140  $\mu$  high, colorless; paraphyses slender, loosely adglutinated; hypothecium pale yellowish; asci inflated-clavate; spores ellipsoid and fusiform-ellipsoid, 28 to 32  $\mu$  long, 12 to 14  $\mu$  thick, 6 or 7-locular and submuriform; hymenial gelatine with iodine faint blue, the asci darker, especially at the apices.

On sandstone and earth among moss, in the Santa Monica Range.

## HEPPIACEAE.

Thallus squamulous-crustaceous, of dark brownish olive green color, closely attached to the substratum by rhizinae; squamules generally monophyllous, (thallus approaching a fruticulose form with us only in *Heppia zahlbruckneri*.) the loosely pseudoparenchymatous structure inclosing Scytonema gonidia—moderately large, pale bluish green



algal cells, mostly several grouped together; apothecia immersed or the disk at times slightly elevated; proper exciple ill developed and a thalline margin often wanting; paraphyses slender, jointed, unbranched; asci paucisporous or multisporous; spores colorless, globular or ovoid; spermatia ellipsoid to oblong, short.

### HEPPIA Naeg.

The only genus. Characters of the family.

#### KEY TO SPECIES.

**Thallus monophyllous or nearly so.**

Strictly monophyllous.

Border irregularly lobate-crenate..... 6. *H. hassei*.

Border entire.

Raised more or less.

Border thin..... 1. *H. bolanderi*.

Border thick, grayish granulose..... 2. *H. guepini*.

Border not raised.

Disk large, solitary..... 3. *H. terrena*.

Disk quite small, solitary..... 5. *H. leptopholis*.

**Thallus submonophyllous.**

Disk large, one to several in squamule..... 4. *H. despreuxii*.

Disk minute, immersed..... 8. *H. polyspora*.

**Thallus not monophyllous.**

Polyphyllous sterile..... 7. *H. conchiloba*.

Subfruticulose..... 9. *H. zahlbruckneri*.

#### 1. *Heppia bolanderi* (Tuck.) Wain.

Squamules dark umber brown, dispersed or crowded and imbricated, orbicular or sinuate and undulating, from 0.5 to 4 mm. in width, centrally loosely attached to the substrate; apothecia imbedded in the thallus, indicated by a minute orifice; spores minute and numerous.

Quite frequent on sand rock in the Santa Monica Range

#### 2. *Heppia guepini* (Delise) Nyl.

Squamules monophyllous, stout, 1.5 to 4 mm. wide, the upper surface brownish olive green, undulate or planoconvex, the border turgid, repand, grayish-granulose, sinuate, entire or interrupted, beneath light brown, centrally affixed to the substrate; apothecia imbedded and rarely seen; asci broadly oblong-ellipsoid; spores minute and numerous.

On various rocks; frequent throughout our district. Eastern and Middle United States; Europe; Australia.

#### 3. *Heppia terrena* Nyl.; Hasse, Bull. Torrey Club 24: 445. 1897.

The mostly dispersed squamules roundish, dark olive green, from 0.75 to 1.5 mm. in width, flattish, the border lightly curved upward, attached to the substrate by thick hyphæ; apothecia one in a squamule, when mature occupying, except a narrow rim, nearly the entire surface of squamules, adnate and slightly projecting above the surrounding thallus; disk circular, flat, red brown when dry, brighter red when moistened, 0.5 to 0.75 mm. in diameter, a thin thalline wall inclosing the thalamium cup-like on the sides and beneath, the thin hypothecium resting almost directly upon the substrate; epithecium subentire, yellow; thecium 140 to 160  $\mu$  high, colorless; paraphyses slender, compact, not thickened nor colored at the tips; hypothecium almost colorless, 60  $\mu$  high; asci 120  $\mu$  long, 32  $\mu$  thick, the wall thick, especially the hoodlike top inclosing the attenuate apex of the cavity; spores regularly globular, numerous, 4 to 4.5  $\mu$  thick; hymenial gelatine with iodine blue, with KHO a handsome purple, except the hypothecium, the epithecium becoming dark brownish purple; spermatogones not seen.



On earth. Type locality, on the western slope of the San Gabriel Range, along the "New Mount Wilson Trail" at 650 meters altitude; Verdugo Mountains above Casa Verdugo; Topanga Canyon, Santa Monica Range at 850 meters.

Type deposited with Doctor Nylander; duplicates with Dr. A. Zahlbruckner and Prof. Bruce Fink, and in herb. Hasse.<sup>1</sup>

**4. *Heppia despreauxii* (Mont.) Tuck.**

Thallus of pale olive green squamules, these small, orbicular, or attaining a width even of 6 to 7 mm., the larger deeply incised and lobed, attached by the entire lower surface to the substrate; apothecia innate, from one in the smaller to a dozen in the larger squamæ; disk depressed, flat, circular, dull brown when dry, brick red when moistened; thecium 130 to 140  $\mu$  high, colorless or pallid yellow in places; epithecium subcontinuous, yellowish; paraphyses loosely coherent, the tips not colored nor thickened; hypothecium pale yellowish, almost colorless; asci saccate, about equaling the thecium; spores 8, large, oblong-ellipsoid, 16 to 22  $\mu$  long, 8 to 10  $\mu$  thick, the exospore thin; hymenial gelatine with iodine sordid blue, no change with KHO.

On earth, widely dispersed; San Bernardino, *Parish*; Santa Monica Range. Throughout the United States; Europe.

**5. *Heppia leptopholis* Nyl.; Hasse, Lich. South. Calif. 10. 1898.**

Squamules mostly orbicular, coarsely pseudoparenchymatous throughout, 1 to 2 mm. wide, concave or flat, yellowish olive green, above finely reticulated and fissured, the entire under surface attached to the substrate by loose hyphæ; apothecia innate, not exceeding 0.5 mm. in width, disk at first little more than punctiform, red, finally larger, round, papillate, flush with the thallus, a complete absence of a proper margin or parathecium; epithecium continuous, yellowish orange, the coloration occupying about one-fifth of the thecium, this otherwise colorless, 180 to 184  $\mu$  high; paraphyses loosely coherent, slender, the tips not colored nor thickened; hypothecium faintly yellowish tinged, almost colorless, of about the thickness of the thecium; asci nearly equaling the height of the paraphyses, upper half of the membrane thickened, the cavity gradually attenuate upward, wine bottle shaped; spores small, regularly globular, 5 to 6  $\mu$  in diameter; with iodine the asci staining blue, especially above, the rest of the hymenial structure yellow, the epithecium dark orange.

"Affinis *Heppiae psammophilae*," Nylander.

On earth. Type locality, foothills of Santa Monica Range near the Soldiers' Home. Also on Santa Catalina Island.

Type deposited with Doctor Nylander; duplicates in the herbarium of the New York Botanical Garden, the U. S. National Herbarium, and herb. Hasse.

**6. *Heppia hassei* Zahlbr. Beih. Bot. Centralbl. 13: 157. 1902.**

Squamules appressed, about 1 mm. in diameter, orbicular, lobate-crenate to irregularly round, mostly approximate, slightly ascending at the margin, homoömerous, pseudoparenchymatous-cellular, the *Scytonema* gonidia glomerulose-concatenate; apothecia solitary in squamules, immersed; disk red brown, flat, primarily punctiform, then dilated to about 1 mm. wide, papillate-roughened; thalline margin thin; hypothecium narrow, yellowish; exciple thin; thecium pale roseate, 120 to 127  $\mu$  high, with iodine vinous red; asci numerous, ventricose-saccate, 100 to 120  $\mu$  long, 22 to 27  $\mu$  thick, the membrane above calyptriform, thickened; epithecium reddish; paraphyses embedded in hymenial gelatine; spores numerous, oval, decolorate, simple, 5 to 7  $\mu$  long, 3.5 to 4  $\mu$  thick, the epispore thin.

On granite. Type locality, Palm Springs at the eastern base of the San Jacinto Range.

Type deposited with Dr. A. Zahlbruckner and in herb. Hasse.

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<sup>1</sup> Prof. B. Fink, Lichens of Minnesota, Contr. U. S. Nat. Herb. 14: 150. 1910, believes this species to be identical with *Heppia despreauxii*. However, aside from the general coarseness of the latter and its one squamule often containing several apothecia, the difference in the spores suffices to establish the authenticity of Nylander's *H. terrena*.



**7. *Heppia conchiloba* Zahlbr. Beih. Bot. Centralbl. 13: 157. 1902.**

The writer is without a specimen; therefore the original description of Dr. A. Zahlbruckner is given:

"Thallus substrato parte centrali innatus, foliaceus, 6-15 mm. in diam., radiatolobatus, lobis conchiformibus, auriculatim confertis, marginibus granuloso-scabridis, siccus coriaceo-cartilagineus, cervino-murinus, opacus, madefactus prasino-virescens, usque 0.3-0.5 mm. crassus, superficie punctulato-granulosus, subtus undique hyphis hypothallinis creberrimis, thallo longioribus, ramosis et intricatis, 9-10  $\mu$  crassis, leptodermaticis, septatis (cellulis 17-20  $\mu$  longis) vestitus; superne pseudoparenchymaticus, gonidiis destitutus, pseudocellulis rotundato-angulosis, sat magnis, 10-13  $\mu$  longis, membrana modice crassa, in seriebus 3-5 horizontalibus dispositis; stratum medullare totum gonidia continens; ex hyphis verticalibus, leptodermaticis, ramosis, 5-5.5  $\mu$  crassis, septatisque (cellulis usque 17  $\mu$  longis) formatum; gonidia *Scytonemea*, glaucescenti-virentia, cellulis magnis, 8-12  $\mu$  in diameter, glomeruloso-concatenatis. Apothecia et pycnoconidia non visa.

"Ad terram agillaceo-sabulosam, Palm Springs, in lateribus orientalibus montium San Jacinto."

**8. *Heppia polyspora* Tuck.**

Thallus of dark olive green squamules, round, entire or lobulate, 2 mm. and less in width, flattened-convex and diminishing in thickness toward the periphery, brownish beneath, attached by central hyphæ to the substrate; squamules containing from a few to 8 apothecia with punctiform, depressed disks; epithecium colorless in the center, becoming brown at the circumference, subcontinuous; thecium 100 to 116  $\mu$  high, colorless in the center and pale brownish outward; paraphyses loosely adglutinate, the tips not thickened nor colored; hypothecium pale yellowish; asci subcylindric, nearly equaling the thecium in height; spores numerous, globular small 2 to 4  $\mu$  in diameter; hymenial gelatine with iodine blue.

On sandstone, Santa Monica Range; on granite, Elsinore, Riverside County.

**9. *Heppia zahlbruckneri* Hasse, Bryologist 14: 100. 1911.**

Thallus of short, erect, terete to subterete lobules, 1 to 2 mm. thick and 3 to 3.5 mm. high, aggregated into groups and loosely attached to the substratum by medullary hyphæ; tops clavate to bulbous, often dilating and assuming a flattened apex; of olive green color or darkening; pseudoparenchymatous cortex, containing the gonidial layer, 40  $\mu$  thick, the pale green *Scytonema* gonidia 6 to 12  $\mu$  in diameter; medullary layer composed of loosely interwoven hyphæ, notably at the axis, from 2 to 3  $\mu$  thick; apothecia 1 to 8 in a lobule head, immersed, marked by a punctiform perforation of the cortex, this sometimes slightly dilated to not exceeding 0.25 mm. in width and depressed; disk dull brown, the flesh-colored, flattened-globular hymenium beneath the gonidial layer; thecium 140  $\mu$  high, colorless; paraphyses loosely coherent, slender; hypothecium colorless or of a pallid yellowish tint; asci quite numerous, the upper part slightly attenuate, the membrane about 3  $\mu$  thick throughout, 112  $\mu$  long, 28 to 32  $\mu$  thick, the immature asci shorter with solid tops, spores globular, 4.5 to 7  $\mu$  in diameter (the liberated spores giving the larger dimension), 24 to 32 being contained in the ascus; hymenial gelatin with iodine a pale indigo blue, changing to sordid pale greenish; KHO giving a bronze red color to the gonidial layer; spermatia not seen.

On quartz in Rubio Canyon, San Gabriel Range, near Pasadena, the type locality. Collected by Mr. C. C. Kingman. It has since been sent from Riverside by Mr. F. M. Reed, and collected by the author at Eden Hot Springs, Riverside County found also (rarely) in the Santa Monica Range.

The species differs from others with similar spore measurements in the shape of the thalline lobules.

Type deposited with Doctor Zahlbruckner; duplicate in herb. Hasse.



## PANNARIACEAE.

Thallus from semicrustaceous to squamulose and subfoliaceous, corticate above, beneath with or without a cortex; medullary layer mostly well developed, containing *Nostoc*, *Scytonema*, or rarely *Pleurococcus* gonidia; hypothallus and rhizinae distinct; apothecia circular, lecanorine or biatorine; paraphyses not branched; asci with 8 colorless, simple, rarely parallel, 3 to 5-locular spores, their membrane thin and destitute of a gelatinous halo; sterigma articulate; spermatia short, straight.

Thallus in ours with blue green *Nostoc* or *Scytonema* gonidia; cortex of upper surface distinct.

## KEY TO GENERA.

## Apothecia lecanorine.

Thallus with *Nostoc* gonidia..... PANNARIA (p. 81).

Thallus with *Scytonema* gonidia..... MASSALONGIA (p. 81).

## Apothecia biatorine or lecideine.

Spores simple..... PARMELIELLA (p. 79).

Spores parallel 2 or more locular..... PLACYNTHIUM (p. 80).

## PARMELIELLA Muell. Arg.

Thallus squamulose, lobed at the periphery or almost foliaceous, attached to the substrate by a distinct hypothallus or by rhizinae; gonidia *Nostoc*; apothecia biatorine, the excipulum without gonidia; asci 8-spored, spores colorless, simple, oblong to ellipsoid.

## KEY TO SPECIES.

Thallus lobed, the lobes linear and cleft..... 4. *P. sonomensis*.

Thallus not lobed, squamulose.

Squamules not imbricated; apothecia rare, minute..... 1. *P. ruderatula*.

Squamules imbricated more or less closely.

Yellowish gray ..... 2. *P. microphylla*.

Greenish gray to brownish ..... 3. *P. lepidota*.

1. *Parmeliella ruderatula* (Nyl.).

*Pannularia ruderatula* Nyl.; Hasse, Lich. South. Calif. 10. 1898.

Thallus of minute, cervine brown, squamulose scales, these from 0.5 to 1 mm. wide and about 0.25 mm. thick, when dry concave and the border connivent, when moistened flat, imbricated, the border minutely crenulate-globular; section of squamule showing above a layer of flattened, hyaline cells, 4 to 6  $\mu$  thick, resting upon a double or triple layer of rounded-quadrangular cells, 10 to 12  $\mu$  thick, beneath this the gonidial layer of blue green *Nostoc* cells, 4 to 8  $\mu$  thick, and below the medullary layer of smaller colorless cells 6 to 8  $\mu$  thick; hypothallus formed of similar dingy brownish cells; apothecia biatorine, sessile, 1 mm. wide and almost entirely covering the squamule, the disk flat, dark purple brown with an entire, lighter colored margin; epithecium subcontinuous, light yellowish brown, gradually paling downward; thecium 112 to 120  $\mu$  high, the lower two-thirds colorless; paraphyses stout, 2 to 3  $\mu$  thick, faintly septate, the slightly clavate tips light brown, some forking above; hypothecium pale straw color; asci inflated-clavate; spores 8, oblong-ellipsoid, 19 to 21  $\mu$  long, 6 to 6.5  $\mu$  thick; hymenial gelatine blue with iodine; spermatia oblong, 6 to 8  $\mu$  long, 0.75  $\mu$  thick, sterigma straight.

On earth. Type locality, foothills of Santa Monica Range above the Soldiers' Home.

Type deposited with Doctor Nylander; duplicates with Prof. Bruce Fink, in the U. S. National Herbarium, and in herb. Hasse.



**2. *Parmeliella microphylla* (Swartz) Muell. Arg.**

Thallus of light yellowish gray, imbricated, crenate-dentate and lobulate squamules 1 to 2 mm. wide; apothecia biatorine, sessile, from 0.25 to 1 mm. wide; disk flat, light brick to reddish-colored with a paler margin, at last convex; epithecium continuous, pale straw color; thecium 112  $\mu$  high, colorless or faint yellowish tinted especially the lower part; paraphyses septate, not well defined, loosely coherent, some forked below the tops, clavate above; hypothecium straw color; asci clavate; spores oblong-ellipsoid, simple, colorless, 14 to 20  $\mu$  long, 5 to 8  $\mu$  thick; hymenial gelatine blue with iodine.

On earth and in earth-covered crevices of rocks, Santa Monica Range. Eastern and southern United States; South America (Chile) and Europe.

The forma *californica* of Tuckerman differs only in the larger size of the spores, the largest being 24 by 9  $\mu$ . It is found in the Santa Monica and San Gabriel ranges (Rubio Canyon).

**3. *Parmeliella lepidiota* (Sommerf.) Herre, Proc. Washington Acad. Sci. 12: 150. 1910.**

*Lecidea carnea lepidiota* Sommerf. Suppl. Fl. Lapp. 174. 1826.

Thallus squamulose, light grayish greenish to chocolate color; squamules about 2 mm. wide, closely imbricated, crenate and lobulate, light gray at the border, beneath whitish, the hypothallus indistinct; apothecia often crowded, sessile, biatorine, 0.5 to 1.5 mm. wide, the disk dull brick red, from flat with a distinct lighter colored margin becoming convex and immarginate; epithecium continuous, pale yellowish brown, 80 to 116  $\mu$  high; paraphyses coherent, stout, septate, slightly clavate at apices; asci cylindric or clavate, extending to the epithecium; spores 8, colorless, ellipsoid, simple, 18 to 20  $\mu$  long, 7 to 9  $\mu$  thick; hymenial gelatine stained blue with iodine except a narrow rim of epithecium, this retaining its natural color, no change with KHO; thallus pseudoparenchymatous throughout, the gonidia Nostoc.

On earth and in crevices of earth-covered rocks. Santa Cruz Mountains, Herre; Santa Monica Range. Western and northern North America, England, and Scotland.

The variety *coralliphora* of authors has the squamules changed to a dense coralloid mass, the fruiting as in the species. It occurs from the Santa Cruz Peninsula, Herre, south to the Santa Monica Range.

The variety *cyanolepra* of authors has the thallus composed of coarse blue gray granules, the apothecia unknown. It has the same range with the species.

**4. *Parmeliella sonomensis* (Tuck.).**

*Pannaria sonomensis* Tuck. Syn. N. Amer. Lich. 1: 126. 1882.

Thallus brownish olive green, of discrete, linear, parted lobes upon a black hypothallus; apothecia minute, lecanorine, sessile, the disk dark; spores fusiform, simple, curved, 20 to 30  $\mu$  long, 3  $\mu$  thick.

On granite, Yosemite Valley; on trap, Topanga Canyon in Santa Monica Range at 270 meters altitude.

**PLACYNTHIUM (Ach.) Harm.**

Thallus crustaceous-areolate, coralline to microsquamulose; hypothallus blue black or obsolete; apothecia sessile, lecideine or biatorine; paraphyses thick, not branched, septate and darkened at the tips; asci clavate, 8-spored; spores oblong to ovoid-ellipsoid, parallel 3 to 9-locular.

**KEY TO SPECIES.**

- Apothecia black; thallus coralloid-squamulose..... 1. *P. nigrum*.  
 Apothecia purplish black; thallus microphylline..... 2. *P. microphyllizum*.



**1. *Placynthium nigrum* (Huds.) S. F. Gray.**

Thallus minutely coralloid-squamulose, brownish, dark olive greenish to dull black, continuous, coralloid when moist, interrupted or diffract when dry; apothecia subinnate, from 0.5 to 1.25 mm. wide; disk black, smooth, biatorine, flat to at last lightly convex; epithecium bluish gray to blue, subgranulose; thecium 60 to 80  $\mu$  high, colorless; paraphyses separate, stout, clavate at the bluish tips with one or two septa below; hypothecium from colorless to fuscescent; asci inflated-clavate, about 20  $\mu$  shorter than the paraphyses; spores 8, colorless, oblong with blunted ends, bilocular to quadrilocular, 16 to 20  $\mu$  long, 5 to 6  $\mu$  thick; hymenial gelatine with iodine blue; gonidia (*Scytonema*) blue green, 8 to 16  $\mu$  in diameter.

On shaded, earth-covered boulders; frequent in the Santa Monica Range. Southern and middle western United States into Canada; England; continental Europe; New Zealand.

**2. *Placynthium microphyllizum* (Nyl.).**

*Pannularia microphylliza* Nyl.; Hasse, Lich. South. Calif. 9. 1898.

Thallus squamulose, light chocolate to cervine brown; squamules small, 1 to 1.5 mm. wide, contiguous, convex with an ascending, crenulate-lobulate border, pale beneath; apothecia sessile, biatorine, 0.5 to 0.75 mm. in diameter; disk dusky red brown, flat, the paler margin at last obscure and the disk lightly convex; epithecium subcontinuous, sordid brownish yellow; thecium 80 to 128  $\mu$  high, colorless; paraphyses loosely coherent, slightly thickened above; hypothecium yellowish, paler than the epithecium; asci inflated-clavate, 56 to 60  $\mu$  high, 18  $\mu$  thick, 8-spored; spores elongate-ellipsoid, 16 to 28  $\mu$  long, 6 to 9  $\mu$  thick, 2 to 4-locular; iodine staining all the hymenial structures deep blue.

Type locality, along the "Old Wilson Trail," San Gabriel Range on quartz and in the Santa Monica Range on sandstone.

Type deposited with Dr. W. Nylander; duplicates with Prof. C. E. Clements, Prof. Clara Cummings, Mr. W. W. Calkins, Dr. J. W. Eckfeldt, in the U. S. National Herbarium, and in herb. Hasse.

**PANNARIA Delise.**

Thallus granulose, squamulose to foliaceous with a blue black or black hypothallus and *Nostoc* gonidia; apothecia primarily innate, at last sessile to lecanorine; hypothecium pallid; spores simple, oblong-ellipsoid and fusiform.

A single species with us.

**1. *Pannaria pezizoides* (Weber) Lightf.**

Thallus minutely squamulose, dusky greenish brown, the squamules densely imbricated, about 1 mm. wide, coarsely crenate at the border, pale beneath; apothecia subinnate, 1 to 1.5 mm. wide; disk brick red and duller red, soon convex with a persistent, prominent, coarsely crenate thalline margin; epithecium pale yellow; thecium colorless, 100  $\mu$  high; paraphyses coherent; hypothecium equaling the epithecium in color; asci elongate-clavate, spores 8, simple, colorless, oblong-ellipsoid with two oil globules and pointed at one or both ends, 20 to 30  $\mu$  long, 8 to 12  $\mu$  thick, sometimes lightly curved; hymenial gelatine with iodine light blue.

On earth near Glenivvy, Riverside County; Topanga Canyon, Santa Monica Range; Matilija Canyon, Ventura County; Yosemite Valley. Ranges throughout northern North America; Europe.

**MASSALONGIA Koerb.**

Thallus microphylline-squamulose, corticate above, ecorticate beneath, the layer of *Scytonema* gonidia situated below the upper cortex, medullary layer loose; apothecia biatorine, marginal; disk flat; hypothecium pallid, imposed upon a gonidial layer; asci 8-spored, the spores fusiform, colorless, bilocular; sterigma jointed, spermatia short, straight.

A single species within our limits.



1. *Massalongia carnosa* (Dicks.) Koerb.

Thallus squamulose, dark brown; squamules lobate, incised, suberect and imbricated, about 2 mm. wide, pale beneath; apothecia small, barely over 0.5 mm. wide, sessile; disk flat, biatorine, dark brown when dry, moistened dark red; epithecium continuous, reddish brown; hypothecium faintly yellowish tinted; thecium 100  $\mu$  high, colorless; paraphyses coherent, septate, some capitate and colored at the top; asci inflated-clavate; spores oblong-ellipsoid, bilocular, 22 to 24  $\mu$  long, 8 to 11  $\mu$  thick, the epispore thin; hymenial gelatine blue with iodine, soon becoming brown.

Among moss on boulders. Yosemite Valley. Arctic Canada; England.

## STICTACEAE.

Thallus frondose-foliaceous, large, horizontally spreading, loosely attached to the substratum, both surfaces corticate; beneath the upper cortex the gonidial layer of *Palmella* or *Nostoc* gonidia; under surface with tomentose rhizinæ and cyphels—circular, depressed perforations of the cortex, or pseudocyphels—roundish, white isidiose spots; apothecia sessile or elevated, scutelliform with a proper margin; paraphyses stout, septate, not branching; spores colorless or colored, fusiform to acicular and bilocular to plurilocular; sterigma multiarticulate; spermatia short, straight, mostly with slightly thickened ends:

Only one genus and one species as yet reported from our district.

## STICTA (Schreb.) Ach.

Characters of the family.

1. *Sticta anthraspis* Ach.

Thallus large, spreading, 5 to 15 cm. wide, tawny brown, deeply lobed, the rounded lobes crenate-lobulate at the border, the upper surface reticulate, deeply and coarsely lacunose, the under surface fawn-colored at the circumference, darkening centrally where affixed to the substratum, and clothed throughout with a dense short nap; white pseudocyphellæ numerous; apothecia sessile along the prominent reticulations, from 1 to 4 mm. in diameter; disk reddish brown, at first concave with a crenulate thalline margin, eventually flattish and the margin obscure; epithecium continuous, brown; thecium 84 to 96  $\mu$  high, colorless or pale brownish in places; paraphyses coherent, gently clavate at the pale brown tips, septate; hypothecium yellow; asci clavate and inflated-clavate; spores fusiform, from mostly bilocular to 4-locular, 22 to 32  $\mu$  long, 5 to 8  $\mu$  thick, epispore thick.

Along the Pacific coast; Westport, Washington, *Foster*; Santa Cruz Peninsula, *Herre*; on oak bark at 800 meters altitude in the San Gabriel Range along the "New Mount Wilson Trail."

## PELTIGERACEAE.

Thallus frondose-foliaceous, mostly large, the upper surface corticate, beneath this the gonidial layer composed of *Palmella* and *Nostoc* gonidia; lower surface reticulate-veiny and villous, ecorticate, affixed to the substratum by bundles of rhizinæ issuing from the veins; apothecia mostly marginal, roundish, sessile or innate upon the upper or under surface of the thallus; asci 2-sporous to multisporeous; spores colorless, light or dark brown, ellipsoid, fusiform to acicular, bilocular to parallel-plurilocular. The family is represented in southern California by one genus.

## PELTIGERA Willd.

Thallus frondose, large, corticate only above, beneath villous and reticulate-veiny; apothecia adnate-sessile on the upper surface of extended lobes, without a true thalline margin; asci 6 to 8-spored; spores colorless, fusiform, parallel 4 to 8-locular, the epispore thin. Gonidial layer beneath the cortex, of blue green *Nostoc* or bright yellow green gonidia.



## KEY TO SPECIES.

Lobes small.

Veins with fibrils.

Veins thick, pale..... 3. *P. rufescens*.

Veins not thick, obscure..... 2. *P. scutata*.

Fibrils almost wanting..... 4. *P. spuria*.

Lobes large.

Smooth above..... 1. *P. canina*.

Sorediate above, especially at the border..... 1a. *P. canina sorediata*.

**1. *Peltigera canina* (L.) Hoffm.**

Thallus foliaceous, large, horizontally spreading, lobes rounded, entire to sinuate, crenate at the border, greenish or brownish, upper surface downy with clustered, stellate, short hairs, beneath whitish with light brown veins and fibrils; apothecia marginal on upper surface, round, brown red; disk flat with a finely crenate spurious margin; epithecium pallid, subcontinuous; thecium colorless or with a tint of yellow, 100 to 108  $\mu$  high; paraphyses coherent, strict, septate, slightly clavate and colored at the tips; hypothecium small-celled, pale yellowish; asci narrow clavate; spores fusiform, 5-locular, 56 to 68  $\mu$  long, 4 to 5  $\mu$  thick; hymenial gelatine with iodine deep blue, except the unchanged epithecium.

On earth and rocks among mosses. San Bernardino Mountains, *Parish*; San Gabriel and Santa Monica ranges; Yosemite Valley. Throughout North America; mountains of tropical and South America; Europe.

**1a. *Peltigera canina sorediata* (Schaer.) Fink, Bull. Lab. Nat. Hist. Univ. Iowa 3: 76. 1895.**

*Peltigera canina spuria sorediata* Schaer. Enum. Lich. Eur. 21. 1850.

Smaller, brown above, not villous, the border turned up, crimped and gray sorediate, beneath darker than in the species; no fruiting specimens seen. On earth among moss in the San Gabriel Range.

**2. *Peltigera scutata* (Dicks.) Leight.**

Thallus small, smooth above, dusky brown, the lobules rounded, small with entire border, beneath paler brown than above, the fibrils short and stout and the veins not prominent, often of the same color as the under surface; apothecia on scarcely elongated lobules, short and broad, the disk dull blackish brown; spores acicular, 30 to 70  $\mu$  long, 4 to 5  $\mu$  thick, 5 to 8-locular.

On earth, Lytle Creek, San Bernardino Mountains, *Parish*.

**3. *Peltigera rufescens* (Neck.) Hoffm.**

Thallus middling large, light brown (in herbarium), slightly downy and roughened above, paler beneath with thick, pale veins, the lobes rounded, less deeply incised than in *P. canina*, the border crenulate; apothecia on elongated lobules, oblong with a nearly entire margin, the disk dark red brown; spores acicular, 42 to 60  $\mu$  long, 3 to 5  $\mu$  thick, 4 to 8-locular.

On earth near San Bernardino, *Parish*. Throughout North America; Europe; northern Africa; Hawaiian Islands.

**4. *Peltigera spuria* (Ach.) Lam. & DC.**

Lobes small, less than 1 cm. wide and 1.5 to 2 cm. long, light brown and obscurely villous above, ascending, with slightly crenulate border, beneath of lighter color, scarcely villous the veins concolorous and almost destitute of fibrils; apothecia at end of lobule, broader than long, with revolute, thin, crenulate margin; disk flat, dark brown black; epithecium continuous, reddish brown, gradually paling downward; thecium 120  $\mu$  high, colorless below; paraphyses strict, coherent, dimly septate, slightly clavate and faintly colored at the tips; hypothecium pale reddish brown; asci narrowly clavate, the membrane thickened at top, 86 to 100  $\mu$  long, 14  $\mu$  thick;



spores fusiform, acicular,  $68\ \mu$  long,  $4\ \mu$  thick, 5 or 6-locular; with iodine the asci staining blue, the rest of the hymenial structures orange red.

On earth; San Bernardino Mountains, *Parish*; Matilija Canyon, Ventura County; Yosemite Valley. Northern Atlantic Coast; Europe; Tasmania; New Zealand.

### PERTUSARIACEAE.

The genus *Pertusaria* is the sole representative of this family with us.

#### PERTUSARIA Lam. & DC.

Thallus crustaceous, uniform, intimately affixed to the substratum by medullary or hypothalline hyphæ, the gonidial layer, covering the medullary, composed of *Cystococcus* gonidia (synonyms *Pleurococcus*, *Protococcus*); apothecia either lecanoroid with a thalline margin, or the hymenia immersed in thalline verrucæ, one to several in each, the disk then contracted, punctiform or seen as a mere depression of the thalline wart; paraphyses branching, slender; asci containing 1 to 8 spores, these simple, colorless, generally very large, the epispore thick; spermogones immersed in the verrucæ; spermatia cylindric to acicular.

#### KEY TO SPECIES.

Growing on rock.

Thallus sulphur-colored, rimose..... 2. *P. flavicunda*.

Thallus whitish gray, smooth..... 3. *P. nolens*.

Growing on bark.

Thallus whitish to light gray.

Disk pruinose, flesh-colored..... 1. *P. lecanina*.

Disk not pruinose, dark, small..... 6. *P. leioplaca*.

Thallus dark ash gray.

Disk dilated, round, black..... 4. *P. wulfenii*.

Disk punctiform, stellate or irregular-shaped..... 5. *P. pustulata*.

#### 1. *Pertusaria lecanina* Tuck.

Thallus smooth, becoming slightly rugulose, creamy yellow, with a dark hypothalline border; apothecia sessile, from 0.5 to 1.25 mm. in width; disk with a thalline margin, primarily flat, thickly pruinose, at last slightly depressed and pale rose color, KHO staining the thalline margin of the mature apothecia orange, then red, the thallus faint yellowish; this stain of the thalline margin appearing on the species only when growing upon *Juglans californica*; epithecium colorless; thecium colorless; paraphyses free, slender, forked; hypothecium colorless; asci thick-walled, 2-spored; spores 112 to 140  $\mu$  long, 40 to 48  $\mu$  thick, the epispore very thick; hymenial gelatine with iodine a deep blue.

On the smooth barks of the wild walnut, and of *Quercus agrifolia*; less common on other barks. Frequent in the Santa Monica Range. According to Tuckerman it occurs in small patches accompanying *Pertusaria leioplaca* and *P. communis*; in Southern California the patches are often large and without the association of these two species.

#### 2. *Pertusaria flavicunda* Tuck.

Thallus sulphur-colored, rimose-areolate, the areoles angular, granular or minutely verruculose, diminishing in size toward the circumference or becoming indistinctly radiate; hypothallus pallid, KHO+yellow, Ca(ClO)<sub>2</sub>+orange; apothecia sessile, verrucose; disk flat, somewhat impressed, dark dusky yellowish pruinose, round or angular, in places the apothecia supplanted by isidiose glomerules; spores 2 or 3, ovoid-ellipsoid, 80 to 84  $\mu$  long, 46 to 52  $\mu$  thick, the epispore very thick; hymenial gelatine deep blue with iodine, the spores yellow.

On rocks and siliceous pebbles at San Diego; at Del Mar; calcareous rocks near Santa Monica; Santa Catalina Island. Appears to favor localities not distant from the ocean.



**3. *Pertusaria nolens* Nyl.**

Thallus thin, smooth, leaden gray or dull ash gray, finely rimose-areolate, KHO—,  $\text{Ca}(\text{ClO})_2$ —, with determinate outline and a pale hypothallus; apothecia 1 or 2 to an areole, immersed, minutely crateriform or mostly irregular in shape and from the fissured thalline margin appearing stellate; disk dark; thecium colorless; paraphyses slender, branched and interwoven; asci cylindric-oblong, 120 to 140  $\mu$  long, 32 to 36  $\mu$  thick, 8-spored; spores ellipsoid, 32 to 42  $\mu$  long, 14 to 22  $\mu$  thick, acuminate-pointed at the ends, the endospore smooth or barely wrinkled; hymenial gelatine with iodine yellow and only the asci blue.

On schistose rocks in the Santa Monica Range (Sepulveda and Rustic canyons). Externally it is similar to and easily confounded with *Lecanora laevata* Nyl.

**4. *Pertusaria wulfenii* Lam. & DC.**

Thallus ash gray, rugose-verrucose and rimose, neither KHO nor  $\text{Ca}(\text{ClO})_2$  giving a reaction; apothecia in elevated, flattened verrucæ; disk blackish, now and then dilated, depressed, with a turgid thalline margin formed by the verrucæ; epithecium grayish yellow, after KHO pale yellow; thecium 240  $\mu$  high; hypothecium colorless; asci ventricose, containing 8 irregularly disposed spores, these ovoid-ellipsoid, 48 to 60  $\mu$  long, 24 to 32  $\mu$  thick, the epispore and ascus membranes thinner than in other species; hymenial gelatine with iodine blue, the spores yellow.

On various barks, Tehachapi Mountains; San Bernardino Mountains at "Seven Oaks"; Santa Catalina Island.

**5. *Pertusaria pustulata* (Ach.) Nyl.**

Thallus light gray with a faint yellow dash, areolate-rimose, one or several semiglobular verrucæ to an areole, KHO+faint yellow,  $\text{Ca}(\text{ClO})_2$ —; apothecia one or more in a wart; disk small, irregularly substellate or merely a punctiform slight depression; epithecium subgranulose, dark yellowish gray; thecium 80  $\mu$  high; hypothecium similar to the epithecium in color; asci tubular or cylindric, iodine staining them a deep blue; spores in 2's, 80 to 136  $\mu$  long, 22 to 48  $\mu$  thick.

On various barks; frequent in the Santa Monica Range.

**6. *Pertusaria leioplaca* (Ach.) Schaer.**

Thallus light yellowish gray, smooth becoming fissured, KHO+yellow then pale violet,  $\text{Ca}(\text{ClO})_2$ —; apothecia in sessile, semiglobular, elevated verrucæ, mostly single, sometimes 2 or 3 to a wart, slightly flattened, the disk small, almost punctiform, dark, indistinct; paraphyses slender, branching; thecium colorless; spores ellipsoid, 44 to 96  $\mu$  long, 24 to 64  $\mu$  thick, from 4 to 8 in an ascus seen in the same section of an apothecium; hymenial gelatine deep blue with iodine, the liberated spores yellow.

On various barks. From Washington, *Foster*; Santa Cruz Mountains, *Herre*; Santa Monica Range. From southern Canada to Texas; Europe; southern Africa; South America.

**LECANORACEAE.**

Thallus crustaceous, uniform or lobed at the periphery, exceptionally fruticulose, without rhizinæ, affixed to the substratum by medullary or hypothalline hyphæ, with or without a cortex; apothecia permanently innate or sessile, with a thalline margin; hypothecium pallid; paraphyses either not branching and separate or branching and interwoven; asci 8 to 32-spored, the spores colorless, simple or parallel-bilocular to plurilocular, or muriform-multilocular; spermatia variously shaped.

**KEY TO GENERA.**

Spores simple.

Crescent-shaped..... *HARPIDIUM* (p. 86).

Globular, ellipsoid, or oblong.

Paraphyses branching, interwoven; spores large.... *OCHROLECHIA* (p. 95).

Paraphyses not branching; spores not large..... *LECANORA* (p. 86).



Spores compound.

Bilocular.

Thallus gray or brown..... LECANIA (p. 95).

Thallus not gray or brown.

Yellow; disk bright-colored..... CANDELARIELLA (p. 99).

Not yellow; disk blackish to black..... PLACOLECANIA (p. 98).

Muriform-multilocular ..... PHLYCTIS (p. 98).

### HARPIDIUM Koerb.

Thallus crustaceous, uniform, areolate; apothecia subinnate, circular, with a thalline margin, a proper margin not apparent; hypothecium pallid; paraphyses not branching, septate; asci 8-spored, the spores colorless, simple, crescent-shaped, the epispore thin; spermogones immersed; sterigma simple, straight; spermatia short, oblong-ellipsoid.

Within our limits only one species.

#### 1. *Harpidium glaucophanum* Nyl.

*Lecanora glaucophana* Nyl.; Hasse, Lich. South. Calif. 11. 1898.

Thallus of dispersed, white, lobulate and lobed squamules, 2 to 4.5 mm. in width, dark beneath, affixed centrally to the substrate, KHO+yellow, Ca(CIO)<sub>2</sub>—; apothecia innate, 1 or 2 in a squamule, 0.5 to 1.5 mm. wide; disk flat, papillate, level with or barely protruding above the thalline surface, reddish brown, becoming black in the herbarium; epithecium subcontinuous, rich reddish brown; thecium colorless, 60  $\mu$  high, with iodine blue, the color of the epithecium unchanged; paraphyses adglutinate; hypothecium of a faint yellowish tint; asci inflated-clavate; spores simple, broadly fusiform crescent shaped, rarely several straight, 11 to 16  $\mu$  long, 3 to 4  $\mu$  thick.

On gneiss and other crystalline rocks. Type locality at Camp Baldy, San Antonio Canyon in the San Gabriel Range, at 1,600 meters altitude.

Type deposited with Dr. W. Nylander; duplicates with W. W. Calkins, in the herbarium of the New York Botanical Garden, and in herb. Hasse.

### LECANORA Ach.

Thallus crustaceous, uniform, lobed at the periphery or squamulose, rarely fruticulose; gonidia *Protococcus algæ* (*Cystococcus* Naeg.); apothecia permanently innate or sessile, bordered by a thalline margin; parathecium (proper exciple) mostly not well developed; paraphyses not branching; hypothecium pallid or colored; spores normally 8, rarely in multiples of the normal, 16 or 32, colorless, ellipsoid or oblong to globular, straight or bean-shaped, thin-walled; spermatia staff-shaped to acicular, straight or curved.

#### KEY TO SECTIONS.

Apothecia permanently immersed; spores large; thallus crustaceous, uniform .....

1. ASPICILIA.

Apothecia sessile.

Thallus crustaceous, uniformly areolate to warty .....

2. EULECANORA.

Thallus crustaceous to squamulate in the center and lobed

more or less at the periphery ..... 3. PLACODIUM.



## KEY TO SPECIES.

Section 1. **ASPICILIA** T. Fries.

- Substratum earth; thallus dull greenish gray, lobate at border.. 5. *L. glaucopsina*.  
 Substratum rock.  
 Thallus disappearing..... 6. *L. praecrenata*.  
 Thallus present, some shade of gray.  
 Disk pruinose..... 1. *L. calcarea*.  
 Disk not pruinose, black.  
 Thallus gray, more or less warty.  
 With KHO no reaction..... 3. *L. gibbosa*.  
 With KHO+red..... 2. *L. cinerea*.  
 Thallus not warty, smoothish..... 4. *L. laevata*.

Section 2. **EULECANORA** Wain.

- Substratum rock.  
 Thallus obsolete; disk brownish..... 17. *L. polytropa*.  
 Thallus present.  
 Apothecia small; disk grayish to brownish..... 10. *L. hageni*.  
 Apothecia larger.  
 Disk naked, black.  
 Apothecia internally black..... 7. *L. atra*.  
 Apothecia internally pale..... 12. *L. coilocarpa*.  
 Disk with some kind of covering.  
 Disk with a bloom, dull yellowish to light  
 brown..... 14. *L. cenisia*.  
 Disk densely pruinose.  
 Pruinose throughout..... 11. *L. sordida*.  
 Not pruinose throughout, the proper mar-  
 gin black..... 11a. *L. sordida bi-*  
*cincta*.  
 Substratum bark (rarely rock).  
 Thallus absent or disappearing.  
 Disk grayish flesh-colored to dull black..... 18a. *L. symmicta sae-*  
*pincola*.  
 Disk buff to pale brown, biatorine..... 16a. *L. varia illu-*  
*soria*.  
 Thallus present.  
 Brown, the disk dark..... 19. *L. phaeobola*.  
 Of some color other than brown.  
 Thallus white to grayish.  
 Apothecia large.  
 Disk black, naked, internally pale..... 12. *L. coilocarpa*.  
 Disk brown..... 8. *L. subfusca*.  
 Apothecia small.  
 Disk naked.  
 Dark brown..... 13. *L. allophana*.  
 Pale brown..... 8a. *L. subfusca dis-*  
*tans*.  
 Disk not naked.  
 Disk with a delicate bloom.  
 Buff color and darkening..... 9. *L. pacifica*.  
 Light grayish..... 10. *L. hageni*.  
 Disk coarsely pruinose..... 15. *L. albella*.  
 Thallus pale greenish yellow.  
 Disk pale buff with a bloom..... 16. *L. varia*.  
 Disk rusty brown, biatorine..... 18. *L. symmicta*.



Section 3. **PLACODIUM** (Hiller) T. Fries.

Thallus peltately affixed.

Disk reddish buff..... 21. *L. rubina*.

Disk black.

Thallus greenish yellow..... 21a. *L. rubina opaca*.

Thallus white..... 22. *L. marginalis*.

Thallus not peltately affixed.

Closely affixed to substratum.

Sulphur-colored, furfuraceous..... 23. *L. pinguis*.

Greenish yellow to darkening..... 20. *L. saxicola*.

Thallus not closely affixed, dull greenish brown, the periph-

eral lobes white-margined..... 24. *L. melanaspis  
alphoplaca*.

**1. Lecanora calcarea** (L.) Nyl.

Thallus crustaceous, white, mealy, rimose-areolate, determinate or subdeterminate; hypothallus pale, KHO—, Ca(ClO)<sub>2</sub>—; medulla not stained with iodine; apothecia immersed, almost punctiform but becoming larger; disk concave, dark but appearing white from a dense pruina, round or angular; epithecium sordid grayish yellow, subgranulose; thecium 216  $\mu$  high, colorless; paraphyses subcoherent, moderately coarse, finely granular, septate, the septa quite close, especially in upper part (visible after KHO); hypothallus colorless; asci ventricose; spores 6 to 8, arranged in one or two files, ovoid and subglobular, 16 to 28  $\mu$  long, 15 to 20  $\mu$  thick; hymenial gelatine stained indigo blue with iodine, turning brownish reddish.

The thallus is often grayish in color, but reactions and measurements are the same.

On calcareous and other rocks. Mountains of Ventura County (Matilija Canyon), frequent in the Santa Monica Range. The thallus varies and the following forms occur:

The forma *hoffmanni* Sommerf., with the thallus of contiguous or discrete verruciform squamules, flattish at the circumference and rising crateriform toward the middle of the squamule, gray, sordid greenish gray, also pale testaceous, the disk not seldom black, naked—is found in the Santa Cruz Mountains, *Herre*, and at Daggett, Mohave Desert, *Parish*. The forma *monstrosa* Cromb. occurs occasionally on sandstone in the Santa Monica Mountains—the verrucæ white, mealy, discrete and scattered, convex with small, immersed, pruinose concave disk, without spores.

**2. Lecanora cinerea** (L.) Sommeri.

Thallus crustaceous, thick, whitish to light gray, rimose-areolate, the areoles angular, flat or slightly concave, smoothish, KHO+ yellow then rusty red, the medulla unchanged with iodine; apothecia immersed, small to minute, from 0.5 to 2 mm. wide; disk at first flat, sometimes finally slightly convex, dull black, the larger moderately umbilicated and sometimes with a thin grayish bloom, bounded by a persistent thalline margin; epithecium forming a thin dark line, subcontinuous; thecium colorless, about 180  $\mu$  high; paraphyses loose, coherent at the tips, septate, as seen after KHO; hypothecium pallid, a fourth of the height of the thecium; asci ventricose, 6 to 8-spored, the spores ovoid, with granular contents, 24 to 28  $\mu$  long, 16 to 20  $\mu$  thick; spermatia straight, acicular, 24 to 32  $\mu$  long; sterigma simple, straight; hymenial gelatine with iodine blue, turning greenish blue.

On granite, Mount Wilson at 1,700 meters; San Antonio Canyon at 1,500 meters; in the San Bernardino Mountains, *Parish*.

**3. Lecanora gibbosa** (Ach.) Nyl.

Thallus thick, gray, rimose-areolate, the areolæ rugulose, warty, KHO—, Ca(ClO)<sub>2</sub>—; hypothallus pallid; apothecia primarily immersed-sessile; disk flat, black, naked, round or by crowding of apothecia irregular, now and then becoming convex, surrounded by a slightly elevated thalline margin; epithecium subcontin-



uous, yellowish gray to smoky brown; thecium 100 to 128  $\mu$  high, colorless; paraphyses coherent; hypothecium colorless or faint yellowish tinted; asci ventricose; spores ovoid, 15 to 32  $\mu$  long, 12 to 20  $\mu$  thick, epispore thick; hymenial gelatine blue with iodine, soon changing to brown.

On various rocks, Santa Cruz Peninsula, *Herre*; Santa Monica Mountains; Tehachapi Mountains at 1,300 meters; San Gabriel Mountains. Canada and the northern United States; Europe; Asia; Japan.

**4. *Lecanora laevata* (Ach.) Nyl.**

Thallus thin, smoothish, delicately rimose-areolate, the areolæ angular, sordid grayish, flat or slightly concave; hypothalline border dull black or bluish black, KHO—, Ca(ClO)<sub>2</sub>—; apothecia small, punctiform to 0.5 mm. wide, immersed; disk concave, black, the thalline margin not or slightly elevated; epithecium pale dingy yellowish brown, subcontinuous; thecium colorless, 132 to 136  $\mu$  high; paraphyses slender, loose, coherent at the apices; hypothecium colorless; spores ovoid, 24 to 28  $\mu$  long, 16  $\mu$  thick; hymenial gelatine dull blue with iodine.

On siliceous pebbles in the Santa Monica Range and at Del Mar; on granite, San Antonio Canyon in the San Gabriel Mountains. Eastern United States; northern Asia; Europe.

**5. *Lecanora glaucopsina* Nyl.; Hasse, Lich. South. Calif. 12. 1898.**

Thallus crustaceous, squamulose, pale grayish greenish, subdeterminate; squamules rugulose, contiguous, and subimbricate, angular or with wavy outline, becoming lobulate at the border, loosely attached to the substratum, KHO—, Ca(ClO)<sub>2</sub>—; apothecia innate or subinnate, often crowded, 0.25 to 0.8 mm. wide; disk flat, black, round or oblong, or by juxtaposition irregularly roundish, when moistened brick red as with a moistened *Heppia*, with a bluish black proper margin and an erect, persistent, entire or subcrenulate thalline margin; epithecium continuous, light brownish; thecium colorless, 140  $\mu$  high; paraphyses septate, the tips slightly or not at all clavate nor colored; hypothecium colorless; asci ventricose or subventricose, with 6 to 8 spores, these ovoid, 18 to 22  $\mu$  long, 11 to 14  $\mu$  thick; hymenial gelatine with iodine blue; spermatia acicular, straight, 20 to 22  $\mu$  long and less than 1  $\mu$  thick.

On clay. Type locality, "Barton's Peak," Santa Monica Range.

Type deposited with Dr. W. Nylander; duplicates with Dr. A. Zahlbruckner and in herb. Hasse.

**6. *Lecanora praecrenata* Nyl.; Hasse, Lich. South. Calif. 12. 1898.**

Thallus diffuse, dirty whitish, indeterminate, or absent; apothecia sessile, circular; disk flat, dusky brown with a white, regularly crenulate thalline margin, the crenules globular, uniform in size, necklace-like surrounding the disk, this margin persistent and slightly elevated; spores 4 to 6, globular, 20  $\mu$  in diameter with finely granular contents and thin epispore; hymenial gelatine with iodine blue turning yellowish green, the spores yellow from the first.

On decomposed granite. Type locality in the Santa Monica Range at "Barton's Peak."

Type deposited with Dr. W. Nylander; duplicate in herb. Hasse.

**7. *Lecanora atra* (Huds.) Ach.**

The crustaceous thallus white, of more or less contiguous verrucæ, with a black hypothalline border, KHO+yellow; apothecia sessile, from 1 to 3 mm. wide; disk black, soon convex, often glistening, with a persistent, entire or coarsely crenulate (Santa Catalina Island) thalline margin; epithecium continuous, bluish black, gradually paling downward and in places staining the thecium to near its base; thecium 68  $\mu$  high; paraphyses coherent; asci clavate, 8-spored, spores broadly ellipsoid, 12 to 13  $\mu$  long, 8.5  $\mu$  thick; hymenial gelatine with iodine blue; epithecium covered by a hyaline, continuous membrane, 2 to 4  $\mu$  thick, sharply defined from the dark



epithecium; with KHO the epithecium turning violet purple. On section the entire hymenium appears black to the unaided eye, this distinguishing it from externally similar lichens.

On various rocks. San Diego, *Cleveland*; Del Mar; Santa Catalina Island; Topanga Canyon in the Santa Monica Range. Throughout the United States, and from the Arctic Regions to Mexico. Europe; Africa; western Asia.

**8. *Lecanora subfusca* (L.) Ach.**

Thallus whitish to light ash color, coarsely granulate, verruculose or also becoming rimose-areolate, generally determinate, KHO+yellow,  $\text{Ca}(\text{ClO})_2$ —; apothecia numerous, crowded or scattered, sessile, from 0.5 to 1.25 mm. wide; disk from plane soon convex, rusty brown, with an entire, permanent thalline margin; epithecium light sordid reddish brown, continuous or subcontinuous; thecium colorless or faintly tinged by the fading color of the epithecium, 60 to 80  $\mu$  high; paraphyses strict, compacted, scarcely thickened at the colorless or barely tinged tips; hypothecium colorless; asci clavate; spores 8, ellipsoid, 12 to 18  $\mu$  long, 7 to 10  $\mu$  thick; hymenial gelatine blue with iodine.

On various barks; common. San Bernardino, *Parish*, and throughout our district.

The species is quite variable and a number of forms are described. The variety *campestris* Nyl. has the thallus rougher, dirty white, the disk brown and darker to dusky black. On rocks, frequent. In the variety *argentata* Ach. the thallus is thin, smooth, white, the apothecia dark brown, smaller than in the species, the thalline margin entire. On bark and dead wood, Santa Catalina Island, *Baker*; Santa Cruz Peninsula, *Herre*; Santa Monica Range.

**8a. *Lecanora subfusca distans* (Ach.) Nyl.**

Thallus thin, smooth to finely granulate, determinate, ashy gray with a thin, black hypothalline border, or indistinct on rough barks, KHO+greenish yellow,  $\text{Ca}(\text{ClO})_2$ —; apothecia sessile, 0.5 to 1.25 mm. wide; disk flat to lightly convex, pale grayish buff with a faint bloom, and with a thin, permanent, finely crenulate thalline margin, becoming flexuose from crowding; epithecium subgranulose, dingy pale yellowish white; thecium 80 to 112  $\mu$  high, colorless; paraphyses coherent; hypothecium colorless; spores oblong-ellipsoid, 15 to 18  $\mu$  long, 8 to 10  $\mu$  thick, with one or two oil globules; hymenial gelatine with iodine blue, particularly upper part of thecium and asci a dull reddish purple, turning sordid brown.

On various smooth barks. Santa Monica and San Gabriel Ranges; at Del Mar.

**9. *Lecanora pacifica* Tuck.**

Thallus whitish, continuous, granulose-verrucose, the hypothallus black; with KHO thallus and thalline margin staining yellow, the disk not affected by  $\text{Ca}(\text{ClO})_2$ ; apothecia sessile, 0.5 to 2.25 mm. wide; disk flat, pale greenish or buff, in color not unlike *Lecanora varia*, or becoming grayish green to blackish, with a faint bloom; the whitish lecanorine margin elevated, thick, persistent, radiately incised-crenate; in general outward appearance the apothecia similar to those both of *Lecanora varia* and *L. pallida*, partaking of the form of the latter and the coloration (disk) of the former; epithecium continuous or finely granulose, sulphur color or light grayish brownish; thecium 72 to 80  $\mu$  high, colorless or sordid, of lighter shade than the epithecium; paraphyses slender, adglutinate; hypothecium similar to the thecium in color; asci subinflated-clavate, almost equaling the thecium in height; spores 8, ovoid-ellipsoid, 11 to 17  $\mu$  long, 6 to 9  $\mu$  thick; hymenial gelatine with iodine deep blue, the spores a pale straw color, KHO giving no reaction.

On barks near San Diego, *Orcutt*; on various barks in the Santa Monica range and doubtless throughout our district, but easily overlooked and mistaken for other *Lecanorae*.



**10. *Lecanora hageni* Ach.**

Thallus thin, verruculose, ash-colored, no reaction with KHO or  $\text{Ca}(\text{ClO})_2$ ; apothecia mostly numerous, sessile, not surpassing 1 mm. in width; disk flat, light brownish or grayish, pruinose; thalline margin thin, white, entire becoming crenulate and flexuose; epithecium colorless, subcontinuous; thecium  $56\ \mu$  high, colorless; paraphyses stout,  $2\ \mu$  thick, septate, the tips lightly clavate and colorless; hypothecium colorless, nearly equaling the thecium in height; asci subinflated-clavate, 44 to  $48\ \mu$  high; spores 8, ovoid-ellipsoid and ellipsoid, 9 to  $16\ \mu$  long, 4 to  $6\ \mu$  thick, variously disposed, longitudinal or transverse; reaction with iodine blue, then sordid reddish brown; spermatia bowed or semicircular.

Common throughout Southern California, on barks and rocks.

**11. *Lecanora sordida* (Pers.) T. Fries.**

Thallus determinate, whitish to ashy white, thick, rimose-areolate, KHO+yellow,  $\text{Ca}(\text{ClO})_2$ —; apothecia innate to adnate-sessile, 0.5 to 2 mm. wide; disk flat and slightly convex, dull black and thickly pruinose; thalline margin turgid, persistent, often sinuate; epithecium gray and yellowish gray, subgranulose; thecium 80 to  $84\ \mu$  high, colorless or lightly yellowish tinged; paraphyses coherent, not thickened above; asci inflated-clavate; spores 8, ovoid-ellipsoid, 10 to  $13\ \mu$  long, 6 to  $8\ \mu$  thick, the epispore thick; hymenial gelatine deep blue with iodine, with KHO no change except in the epithecium, this rendered almost colorless.

On granite and other crystalline rocks; San Bruno Mountain at 350 meters altitude and Santa Cruz Mountains at 800 meters altitude, *Herre*; San Bernardino Mountains; San Gabriel Mountains at 1,500 meters altitude.

**11a. *Lecanora sordida bicincta* (Ramond) T. Fries.**

Apothecia becoming strongly convex and the disk densely pruinose, but the proper margin black, destitute of pruina.

Tehachapi Mountains at 1,600 meters near "Lone Pine Mine."

**12. *Lecanora coilocarpa* (Ach.) Nyl.**

Thallus whitish, thin, smooth becoming granulate, KHO+yellow,  $\text{Ca}(\text{ClO})_2$ —; apothecia sessile, 0.5 to 1.25 mm. wide; disk flat to convex, mostly black (internally pallid), occasionally with a faint bloom, with a thin, entire thalline margin; epithecium continuous, bluish black, after KHO fuliginous; thecium colorless, 64 to  $68\ \mu$  high; paraphyses stout, some forked near the tips and indistinctly septate, slightly clavate; asci cylindric, 52 to  $56\ \mu$  long; spores 8, ovoid-ellipsoid,  $16\ \mu$  long, 7 to  $9\ \mu$  thick; reaction with iodine blue. On various barks and sandstone.

Throughout southern California; San Bernardino, *Parish*.

**13. *Lecanora allophana* Nyl.**

Thallus subdeterminate, sordid white, verrucose, KHO+yellow,  $\text{Ca}(\text{ClO})_2$ —; apothecia sessile, crowded, 0.3 to 1 mm. wide; disk black, flat to convex, thalline margin crenulate and flexuose; epithecium brown, continuous; thecium  $108\ \mu$  high, colorless; paraphyses strict, compacted, coarse, adglutinated at the brownish, clavate tips; hypothecium colorless; asci clavate, reaching into the colored epithecium; spores 8, ellipsoid, 14 to  $20\ \mu$  long, 7 to  $10\ \mu$  thick, the epispore thick; hymenial gelatine with iodine blue, the thecium darker blue and violet; gonidial layer underlying the hypothecium.

On sandstone, Santa Monica Range; on bark, Tehachapi Mountains.

**14. *Lecanora cenisia* Ach.**

Thallus coarsely globular-granulate, or verruculose-areolate, ash gray, subdeterminate or determinate and with a black hypothalline border, KHO+yellow,  $\text{Ca}(\text{ClO})_2$ —; apothecia medium, sessile; disk at first flat, then convex, red brown;



thalline margin in the mature apothecia finely crenulate; epithecium continuous, reddish brown, gradually fading downward, the color disappearing after KHO; thecium colorless, 96 to 128  $\mu$  high; paraphyses strict, loosely coherent or well separated, some with clavate and pale colored tips, septate (after KHO); hypothecium pale yellowish; asci clavate; spores 8, ovoid-ellipsoid, 12 to 18  $\mu$  long, 6 to 11  $\mu$  thick; hymenial gelatine blue with iodine, soon reddish brown.

On rocks, sandstone boulders; San Bernardino Mountains, in Mill Creek Canyon, at 1,500 meters altitude.

**15. *Lecanora albella* (Pers.) Ach.**

Thallus cream color, becoming more yellow or dun color, smoothish, finely rimose, KHO+yellow,  $\text{Ca}(\text{ClO})_2$ —; apothecia sessile, 0.5 to 2 mm. wide, often crowded and from pressure difform; disk flat or undulating, flesh-colored and white-pruinose; thalline margin stout, entire to flexuous and even sinuate, persistent; epithecium granulose, pale grayish yellowish; thecium 80 to 100  $\mu$  high, colorless; paraphyses loosely adglutinated, septate after KHO; hypothecium colorless; asci inflated-clavate, 72 by 20  $\mu$ ; spores 8, ovoid, 12 to 18  $\mu$  long, 6 to 10  $\mu$  thick; hymenial gelatine deep blue with iodine.

Frequent on various barks; Santa Catalina Island, *Baker*; Santa Monica and San Gabriel Ranges; San Bernardino Mountains, *Parish*.

The variety *cancriformis* Tuck. has a rougher, verruciform thallus and difform apothecia with the thalline margin irregular, sinuate-lobate. It occurs with the species.

**16. *Lecanora varia* (Hoffm.) Ach.**

Thallus effuse, pale yellowish greenish to pale buff, thin, areolate-verrucose or granulose, KHO+yellow,  $\text{Ca}(\text{ClO}_2)$ —; apothecia numerous and often crowded, not exceeding 1 mm. in width, sessile; disk from flat to convex, yellowish greenish and buff with a delicate bloom, with a thin crenulate and flexuose thalline margin, later becoming obsolete; epithecium continuous, hyaline; thecium colorless, 56 to 60  $\mu$  high; paraphyses coherent; hypothecium with a very faint yellowish tinge; asci clavate, reaching the height of the thecium; spores 8, oblong-ellipsoid, 11 to 14  $\mu$  long, 5 to 6  $\mu$  thick; the entire hymenium blue with iodine, KHO—.

Frequent on various barks. Santa Cruz Peninsula, *Herre*; near San Bernardino, *Parish*; Santa Catalina Island.

**16a. *Lecanora varia illusoria* Ach.**

Thallus absent; apothecia sessile; disk buff to pale brown, flat to convex and biatorine.

Near San Bernardino, *Parish*. Determined by the late Doctor Stizenberger.

**17. *Lecanora polytropa* (Hoffm.) Schaer.**

Thallus obsolete; apothecia sessile, from 0.25 to 1 mm. wide, crowded or dispersed; disk flat to convex, reddish brown, the thalline margin very thin, becoming obsolete; epithecium subcontinuous, grayish yellow and yellowish brown; thecium 60 to 100  $\mu$  high, sordid pale yellowish or nearly colorless; paraphyses subcoherent, strict, not thickened at the apices; hypothecium of the same hue as the thecium; asci clavate; spores 8, bluntly ellipsoid, 9 to 13  $\mu$  long, 5 to 6  $\mu$  thick; hymenial gelatine with iodine dark sordid blue or violet blue.

On sandstone and conglomerate, Santa Monica Range and Ballona Bluffs.

**18. *Lecanora symmicta* Ach.**

Thallus thin, granulose or pulverulent, KHO+yellow,  $\text{Ca}(\text{ClO})_2$ +orange (the last reaction faint on the specimens collected); apothecia sessile, numerous, small, none over 0.25 mm. wide; disk convex, light rusty brown; thalline margin obsolete (biatorine); epithecium subgranulose, colorless; thecium colorless; 44 to 48  $\mu$  high, paraphyses loosely coherent; hypothecium colorless; asci clavate; spores 8, ellipsoid,



8 to 11  $\mu$  long, 4 to 7  $\mu$  thick; hymenial gelatine with iodine blue, the hypothecium light blue, the final change of blue to "sordid yellow," <sup>1</sup> not observed.

On dead wood near San Bernardino, *Parish* (determination of Doctor Stizenberger). On the same substrate near Los Gatos, *Herre*; on living bark of oak in the Santa Monica Range.

**18a. *Lecanora symmicta saepincola* (Ach.) Nyl.**

Thallus pulverulent, almost disappearing, the chemical reactions of the species not apparent; apothecia sessile; disk flat, grayish flesh-colored to dull blackish with a very thin, finely crenulate thalline margin; epithecium subcontinuous to continuous brown, paling toward the periphery; thecium 48 to 56  $\mu$  high, almost colorless, pale brown in the center; paraphyses coherent; hypothecium a little darker than the epithecium; asci clavate; spores ovoid-ellipsoid, 8 to 10  $\mu$  long, 4 to 5  $\mu$  thick; hymenial gelatine with iodine deep blue.

On dead pine limbs, Strawberry Valley, San Jacinto Mountains, at 1,300 meters; on decaying wood and dead oak bark in the Tehachapi Mountains at about the same altitude.

**19. *Lecanora phaeobola* Tuck.**

Thallus of small light brown to brown papillæ, roundish or crenulate, KHO—, Ca(ClO)<sub>2</sub>—; apothecia closely sessile, small, 0.25 to 0.5 mm. wide; disk flat, dark brown to blackish with a thin concolorous margin, this finally obsolete; epithecium subcontinuous, grayish brown; thecium 64 to 68  $\mu$  high, colorless; paraphyses subcoherent, the tips clavate and light brown, some furcate under the apices; hypothecium pale brown; asci clavate; spores 8, oblong-ellipsoid, 10 to 18  $\mu$  long, 4 to 5  $\mu$  thick.

On dead *Pinus lambertiana* in the Sierra Nevada near Wauwona, at 1,400 meters altitude.

**20. *Lecanora saxicola* (Poll.) Ach.**

Thallus adpressed, pale greenish yellow, glaucous to yellowish brown (especially becoming so in the herbarium), forming round patches, rimose-areolate in the center, radiately spreading and lobed at the periphery, the contiguous lobes there flattened, dilated and crenate at the border; apothecia sessile, crowded at the center; disk flat, concolorous with the thallus, more yellowish; thalline margin persistent, entire to crenulate, regular or contorted; epithecium continuous, sordid pale yellowish; thecium 52 to 72  $\mu$  high, colorless; paraphyses strict, capillary, subcoherent, septate, the apices not or but slightly thickened; hypothecium sordid pale yellowish; asci inflated-clavate, equaling the thecium in height; spores 8, oblong-ellipsoid, 11 to 16  $\mu$  long, 6 to 7  $\mu$  thick; hymenial gelatine blue with iodine; sterigma simple, straight; spermatia acicular, arcuate.

Common on various rocks, from the lowlands ascending the higher mountains. San Bernardino Mountains, *Parish*; near Riverside, *Reed*; frequent in the Santa Monica Range.

The species varies somewhat and the following forms are found: The variety *diffracta* Fries has the thallus darker, light yellowish brown, the areoles more diffract and black margined. At Mount Wilson, San Gabriel Range. The variety *semitensis* Tuck. with the thallus reduced to smaller, scattered, dusky yellowish squamules may yet be found in the higher mountains of our territory. The variety *versicolor* Fries has the thallus pale, white pruinose and depressed at the periphery, the thalline margin white pulverulent. At lower elevations. Topanga Canyon of the Santa Monica Range at 280 meters.

**21. *Lecanora rubina* (Lam. & DC.) Ach.**

Thallus subfoliaceous, pale, yellowish green, spreading at the periphery by short, turgid, rounded, crenate lobes, beneath leather color, blackening toward the circum-

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<sup>1</sup> Cromb. Monogr. Brit. Lich. 433. 1894.



ference, affixed centrally by a short pedicel; apothecia sessile and adnate-sessile, usually crowded in the center; disk light buff to reddish buff, mostly concave with a prominent, persistent, entire to sinuate and crenulate thalline margin; epithecium granulose, pale yellow, with KHO darkening to yellowish brown; thecium  $52\ \mu$  high, yellowish orange; paraphyses coherent; hypothecium orange, paling from the center outward; asci inflated-clavate; spores 8, ovoid, 7 to  $12\ \mu$  long,  $4.5$  to  $6\ \mu$  thick.

On granitic rocks in the higher mountains. San Bernardino Mountains, *Parish*; San Gabriel, San Jacinto, and Tehachapi Ranges.

**21a. *Lecanora rubina opaca* (Ach.) Fries.**

Thallus greenish yellow, pediculately affixed as in the species, but less markedly foliose at the margin; disk black.

Of same habitat and distribution as the species. San Bernardino Mountains at 3,400 meters, *Parish*; in the San Jacinto Mountains at a similar elevation.

**22. *Lecanora marginalis* Hasse, Bryologist 13: 112. 1910.**

Thallus monophyllous, white and finely white-pruinose above, roundish or flexuose in outline, 0.75 to 1.5 cm. in diameter, at the center about 0.5 mm. thick, but increasing somewhat toward the circumference, umbilicately attached at the center to the substratum; upper surface smooth or rugulose-warty and at the periphery becoming convolutely folded, beneath tawny flesh-colored, destitute of rhizinæ; upper cortex composed of several layers of perpendicularly arranged brown cells, bleaching with KHO, beneath this the gonidial layer, the subtending medulla with horizontal, delicate, closely interwoven hyphæ about  $1\ \mu$  thick, the inferior cortex showing several layers of large round cells; thallus with KHO  $\mp$  yellow,  $\text{Ca}(\text{ClO})_2 =$ ; apothecia adnate, all marginal, a few to each frond or when more, crowded and deformed from pressure, 1.5 mm. to less in diameter, the periphery of the frond often revolute and the apothecia facing toward the substratum; disk black, thickly pruinose, rarely naked, concave to flattish and wavy, the turgid thalline margin coarctate, flexuose, and often deformed by juxtaposition; epithecium subcontinuous, dull brownish black; thecium colorless or light ochraceous, 48 to  $52\ \mu$  high; paraphyses stout,  $2\ \mu$  thick, coherent, separating after action of KHO, scarcely thickened above; hypothecium of coarse cells and of the same hue with the epithecium; asci clavate and inflated-clavate,  $48\ \mu$  high, 10 to  $22\ \mu$  thick, 8-spored; spores globular,  $8\ \mu$  in diameter, to ovoid-ellipsoid, 9 to  $14\ \mu$  long,  $6.5$  to  $8.5\ \mu$  thick, the epispore thin; all hymenial structures staining deep blue with iodine; KHO bleaching the epithecium a pale steel blue; gonidia bright green, 12 to  $28\ \mu$  in diameter; spermogones indicated by generally numerous, minute black dots, immersed, globular; spermatia acicular, curved, 32 to  $40\ \mu$  long, hardly  $1\ \mu$  thick; sterigma simple, straight, attenuate above.

On shaded lava and basaltic rocks near Little Lake Station, Inyo County, at 1,000 meters altitude. From its color a conspicuous lichen; occurring on the lower side of inclined dark volcanic rocks.

**23. *Lecanora pinguis* Tuck.**

Thallus light sulphur yellow, closely adherent, mealy, at the center indistinctly rimose-areolate and turgid-convolute, conspicuously radiate at the periphery, the radii contiguous, paling, flattening and dilated at the border, the hypothallus pallid; thallus with KHO  $+$  yellow,  $\text{Ca}(\text{ClO})_2 +$  bright orange, forming round patches from 2 to 4.5 cm. in diameter; apothecia sessile, centrally crowded; disk concolorous with the thallus, concave or flat, appearing almost urceolate from the turgid, somewhat coarctate, sinuous thalline margin; epithecium continuous, sordid yellowish light brown; thecium 68 to  $72\ \mu$  high, light yellow; paraphyses strict, slender, compacted, not thickened above; hypothecium yellow, about equaling the thecium in height; asci clavate; spores oblong-ellipsoid, 11 to  $15\ \mu$  long, 4 to 5.8 thick; hymenial structures blue with iodine, with KHO yellow; spermogones not seen.

On sandstone near San Diego, *Orcutt*.



**24. *Lecanora melanaspis alphoplaca* (Wahl.) T. Fries.**

Thallus crustaceous centrally, covered by the numerous apothecia, at the periphery becoming lobed, the lobes oblong or rounded, entire or variously lobed and even stellate in outline, dull brownish gray with a more or less marked whitish margin, the peripheral lobes not closely affixed, whitish beneath, each containing one to several apothecia; apothecia becoming large, from 0.5 mm. to 1.5 mm. wide; disk from plane with an entire, elevated margin to finally convex with the margin obsolete, darker in color than the thallus to at last dull black, a few showing a faint whitish bloom in the center, the greater number naked; epithecium subcontinuous, brown; thecium colorless, 64 to 72  $\mu$  high; paraphyses coherent, thick, about 2 or 3-septate as seen after KHO, not furcate; asci clavate, 40  $\mu$  long, 14  $\mu$  thick, nearly reaching the colored epithecium; hypothecium colorless; spores 8, ovoid, 9 to 11  $\mu$  long, 5 to 6  $\mu$  thick, the epispore thin and indistinct, the spore contents minutely granular, giving the spore-containing ascus the appearance of an *Acarospora*; hymenial gelatine with iodine blue, rapidly changing to a rich, dark copper red, the epithecium not becoming stained; KHO giving finally a sordid orange color; no change with  $\text{NO}_5$ , except a bleaching of the epithecium.

On quartz rock at Eden Hot Spring, Riverside County.

**OCHROLECHIA Mass.**

Thallus crustaceous, uniform, rimose-areolate to warty; spores large; paraphyses branched and intertwining.

**1. *Ochrolechia pallescens* (L.) Mass.**

Thallus thick, white to pale gray, rimose-areolate, the areolae often warty, KHO—,  $\text{Ca}(\text{ClO})_2$ —; hypothallus pallid; apothecia sessile and adnate-sessile, 1 to 3 mm. wide; disk flat, pale yellowish red, smooth or papillate, with a turgid, permanent, erect, entire thalline margin, the disk and margin with KHO ( $\text{Ca}(\text{ClO})_2$ ) + pale red; thecium colorless; paraphyses slender, branching and intertwining; hypothecium colorless, resting upon the gonidial layer; asci elongate-ventricose; spores 8, ellipsoid, 50 to 64  $\mu$  long, 24 to 32  $\mu$  thick; reaction with iodine blue.

On various barks. In southern California in the higher mountains, mostly on bark of *Pseudotsuga macrocarpa*. Santa Catalina Island, *Trask*. Throughout North America; northern Asia; western Africa; South American Andes; Europe.

**LECANIA Mass.**

Thallus crustaceous, uniform, occasionally lobate at the periphery or squamulose, the squamules rarely warty; gonidia *Pleurococcus*.

**KEY TO SPECIES.**

Substratum bark.

Spores 2-locular.

Thallus whitish, thin..... 1. *L. dimera*.

Thallus gray, effuse, thin..... 7. *L. cyrtella*.

Spores 2 to 4-locular; thallus whitish to grayish, chinky... 8. *L. syringea*.

Substratum rock.

Thallus obsolete; apothecia biatorine..... 4. *L. toninioides*.

Thallus present.

Thallus more or less brown.

Reddish brown, verrucose..... 9. *L. dudleyi*.

Pale grayish brownish, squamulose..... 5. *L. brunonis*.

Thallus gray or white.

Gray; squamulose.

Squamules coarse..... 3. *L. turicensis californica*.

Squamules rather small..... 6. *L. subdispersa*.

White..... 2. *L. erysibe*.



**1. *Lecania dimera* (Nyl.) Olivier.**

Thallus thin, whitish, forming small, roundish, smooth patches from 0.5 to 1.5 cm. in diameter, occasionally finely granular, fringed by a pallid hypothallus; apothecia minute, biatorine; disk flattish to convex, light brown and darkening; epithecium granulate, light brown; thecium 60 to 64  $\mu$  high; paraphyses free, not septate, light brown at the tips; asci narrowly clavate, 8-spored; hypothecium colorless or tinted faint yellow; spores oblong-ellipsoid, bilocular, straight or slightly curved, 12 to 16  $\mu$  long, 4 to 4.5  $\mu$  thick; reaction with iodine blue.

On smooth bark of *Juglans californica*.

Canyons of the Santa Monica Range.

**2. *Lecania erysibe* (Ach.) T. Fries.**

Thallus of dispersed or loosely congregated, light ash-colored or whitish pulverulent, small squamules, scarcely exceeding 0.5 mm. in width, KHO—, Ca(ClO)<sub>2</sub>—; apothecia numerous, scattered, sessile, 0.3 to 1 mm. wide; disk flat, soon convex with a delicate bloom, occasionally tuberculate, light brown to light blackish brown, mostly paling toward the circumference, at first with a thin, crenulate thalline margin this at last disappearing; epithecium subcontinuous, dingy yellowish; thecium colorless, 68 to 88  $\mu$  high, staining blue with iodine; paraphyses subcoherent; hypothecium dingy pale yellowish; spores oblong, simple or bilocular, 12 to 16  $\mu$  long, 4.5 to 5  $\mu$  thick.

On calcareous sandstone, Topanga Canyon of the Santa Monica Range; on a similar substratum at Newport Bluffs; on bleached bones on San Nicolas Island, *Trask*.

**3. *Lecania turicensis californica* Zahlbr. Beih. Bot. Centralbl. 13: 159. 1902.**

"A planta typica (Hepp. Flecht. Europ. no. 8) differt thallo epilithico haud evoluto, apotheciis parum minoribus, normaliter pruinosis, madefactis fuscis et sporis angustioribus, 10 to 12  $\mu$  longis et 3.5 to 4  $\mu$  latis."

On calcareous rock, Santa Ynez Canyon of the Santa Monica Range.

The only specimen found was deposited with Dr. A. Zahlbruckner and the plant has not been collected since.

**4. *Lecania toninioides* Zahlbr. Beih. Bot. Centralbl. 13: 160. 1902.**

Thallus an ash gray squamulose crust; squamules small, roundish, angular or sinuate-lobate, concave, contiguous and subimbricate, the border whitish; apothecia dispersed, adnate-sessile to sessile, 1 to 1.5 mm. wide; disk flat to lightly convex, at times slightly depressed in the center, dusky grayish with a faint bloom, the thalline margin whitish, thin, entire, becoming obsolete; epithecium subgranulose; thecium pallid, 70 to 90  $\mu$  high; paraphyses coherent, not septate, tips clavate, brownish; hypothecium pale; asci oblong-clavate, equaling the thecium in height; spores 8, fusiform-oblong, bilocular, straight or lightly curved, 15 to 20  $\mu$  long, 4 to 5  $\mu$  thick; spermatia hook-shaped, 16 to 20  $\mu$  long, about 1  $\mu$  thick.

On clay. Type locality, Ballona Bluffs, near Santa Monica.

Type deposited with Dr. A. Zahlbruckner; duplicate in herb. Hasse.

**5. *Lecania brunonis* (Tuck.) Herre, Proc. Washington Acad. Sci. 12: 188. 1910.**

*Lecanora brunonis* Tuck. Gen. Lich. 116. 1872.

Thallus of small verrucæ or flattening to squamules forming an areolate crust, greenish gray to greenish brown, at times the squamules round or crenulate, contiguous or imbricate, the color darkening to dull greenish black, KHO—, Ca(ClO)<sub>2</sub>—; apothecia adnate-sessile; disk brown to dull blackish, concave to flat, the thalline margin crenulate and sinuate, finally obscure; epithecium umber brown, continuous, paling downward; paraphyses strict, coherent, some forked below the globular heads; thecium colorless or pale yellowish, 100  $\mu$  high; hypothecium amber color; asci inflated-clavate, 80 to 86  $\mu$  high; spores 8, bilocular, oblong-ellipsoid, 12 to 20  $\mu$  long, 4 to 7  $\mu$  thick; hymenial gelatine with iodine intense blue; spermatia hook-shaped, 16 to 24  $\mu$  long.



On sandstone boulders in the Santa Monica Range; near Murietta, Riverside County; not seen in the higher mountains; on Santa Catalina Island. Type locality near Oakland, California.

**6. *Lecania subdispersa* (Nyl.).**

*Lecanora subdispersa* Nyl.; Hasse, Lich. South. Calif. 12. 1898.

Thallus crustaceous, of small, pale gray or grayish greenish, imbricated squamules forming small, scattered patches (in the type specimen squamules of sterile *Lecania brunonis* intermixed); apothecia sessile, minute, not exceeding 0.8 mm. in width; disk flat, dull reddish brown and blackening, the lighter colored margin at last disappearing; epithecium subcontinuous, light brown, staining violet brown with KHO; thecium 60 to 68  $\mu$  high, violet brown at upper third, below colorless; paraphyses separate, colored at the clavate tips; hypothecium colorless or light brownish to brown; asci oblong-ellipsoid, 44  $\mu$  long, 12  $\mu$  thick; spores 8, ellipsoid, 9 to 13  $\mu$  long, 3 to 4.5  $\mu$  thick, bilocular; sterigma simple, straight; spermatia acicular, slightly curved to arcuate.

On a sandstone boulder in "Stone Canyon," Santa Monica Range (type locality); at Newport Bluffs on sandstone.

**7. *Lecania cyrtella* (Ach.) Olivier.**

Thallus dark gray, when moist greenish gray, smooth or chinky and finely pulverulent, uniform, effuse; apothecia minute, impressed-sessile, from brick red with a lighter colored margin (the latter finally obsolete), darkening to brown and lurid blackish; epithecium grayish; paraphyses coherent; thecium 60  $\mu$  high; asci inflated-clavate and subpyriform; spores 8, ellipsoid, bilocular, colorless, 10 to 16  $\mu$  long, 3 to 5  $\mu$  thick; hymenial gelatine with iodine staining a dark claret color.

On various barks in the Santa Monica Range.

**8. *Lecania syringea* (Ach.) T. Fries.**

Thallus whitish or grayish white, glaucous, smooth or finely rimose-areolate, KHO—,  $\text{Ca}(\text{ClO})_2$ —; apothecia adnate-sessile, 0.25 to 1 mm. wide; disk flat to light convex, pale grayish flesh color with a bloom to almost black, the moderate, thin, entire thalline margin persistent; epithecium subcontinuous, dull violaceous brown, gradually paling downward; thecium 60 to 72  $\mu$  high, colorless, with iodine blue; paraphyses subcoherent, not septate, clavate and slightly colored at the tips; hypothecium colorless; asci clavate; spores 8, oblong or ellipsoid-oblong, bilocular to quadrilocular (the former state more frequent with us), 12 to 20  $\mu$  long, 5 to 7  $\mu$  thick, often slightly curved. A form occurs at Del Mar on dead bark of oak with a marked pruinose disk.

Common in southern California; San Bernardino, *Parish*. Northern part of North America and Europe.

The variety *metabolica* Nyl., with small, dark brown to blackish biatorine apothecia, occurs in canyons of the San Gabriel Range on bark of *Acer macrophyllum*.

**9. *Lecania dudleyi* Herre, Proc. Washington Acad. Sci. 12: 188. 1910.**

Thallus crustaceous, of cartilaginous, coarse, semiglobular warts, grouped or dispersed, light brown to red brown; apothecia primarily immersed in the warts, then innate-sessile, forming a cupola to the thalline wart; disk dark brown, papillate, the proper margin indistinct, the gonidial layer subtending the hypothecium; thecium 96  $\mu$  high; paraphyses adglutinate; hypothecium colorless; spores 8, bluntly ellipsoid, bilocular, 12 to 16  $\mu$  long, 6 to 7.5  $\mu$  thick; hymenial gelatine dark blue with iodine.

On calcareous rocks on the beach at White Point, near San Pedro, and at Highland Park, near Los Angeles, upon the same substratum.



**PLACOLECANIA** (Steiner) Zahlbr.

Thallus crustaceous; spores 2 to 4-locular; sterigma simple or branched, endobasidial.

1. **Placolecania candicans** (Fries) Zahlbr. in Engl. & Prantl, Nat. Pflanzenfam. 1<sup>1\*</sup>: 205. 1907.

*Lichen candicans* Dicks. Pl. Crypt. Brit. 3: 15. 1793.

Thallus whitish, mealy, forming round patches, areolate-rimose in the center or squamulose, the scales somewhat dispersed and then lobulate, at the circumference becoming lobulate-radiate, KHO—; apothecia sessile; disk dull brown black, with a faint bloom and with a turgid, finely crenulate thalline margin; epithecium grayish brown, subcontinuous; thecium colorless, 96 to 102  $\mu$  high, with iodine deep blue; paraphyses coherent, strict, not septate nor forked, the tips capitate and slightly colored; hypothecium nearly colorless or with a very faint yellowish tint; asci clavate, 8-spored; spores oblong-ellipsoid, 11 to 17  $\mu$  long, 4 to 5  $\mu$  thick; spermatia staff-shaped, 4 to 8  $\mu$  long, 1  $\mu$  thick; sterigma straight, simple; gonidial layer extending under the hypothecium.

On calcareous rocks, Santa Catalina Island, and argillaceous shale in the Santa Monica Range.

**PHLYCTIS** Wallr.

Thallus crustaceous, thin, spreading, scaly-pulverulent; apothecia persistently immersed, the thalline margin irregularly lacerate; asci 1 or 2-spored; spores colorless, oblong-ellipsoid, muriform, the epispore thin; sterigma simple; spermatia elongate, straight.

## KEY TO SPECIES.

- Spores with blunt, rounded ends..... 2. *P. argena*.  
 Spores with an acuminate cell at each end..... 1. *P. agelaea*.

1. **Phlyctis agelaea** (Ach.) Koerb.

Thallus subdeterminate, thin, white or oftener grayish white, mealy, KHO+yellow, then red; apothecia very small; disk black, white-pruinose; thalline margin thin, white, pulverulent; epithecium yellowish brown, granulose, with KHO+orange brown; thecium 120  $\mu$  high, colorless, with iodine the hymenial gelatine yellowish, the ascus wall permanently blue; paraphyses separate; hypothecium similar to the epithecium, with iodine brown; asci ventricose, 88  $\mu$  long, 24  $\mu$  thick; spores 2 or sometimes solitary, muriform-multilocular, decolorate, at each end a small but distinct apical, acuminate cell, 48 to 84  $\mu$  long, 14 to 20  $\mu$  thick, with iodine staining yellow to orange; sterigma simple; spermatia short, straight.

On barks (*Populus trichocarpa* and *Salix lasiolepis*) in canyons of the Santa Monica Range; on *Acer macrophyllum* in the San Gabriel Range.

2. **Phlyctis argena** (Ach.) Koerb.

Thallus thin, white, smooth or slightly rugulose, effuse, KHO+yellow, then red, particularly the thalline margin; hypothallus pallid; apothecia adnate, small, not exceeding 0.5 mm. in width; disk brown black to black, flat; thalline margin white, pulverulent, crenulate, often thickly pruinose, semitranslucent when moist; epithecium granulose, yellowish; thecium colorless, 104 to 140  $\mu$  high; paraphyses separate, simple, not thickened at the adglutinated apices; hypothecium colorless or dingy brown; asci 169  $\mu$  long, 80  $\mu$  thick; spores solitary, 100 to 140  $\mu$  long, 44  $\mu$  thick, colorless, muriform, oblong, with rounded ends; with iodine the asci staining blue and the spores yellow.

On barks, Santa Cruz Mountains, *Herre*; in the canyons of the Santa Monica and San Gabriel Ranges.



**CANDELARIELLA** Muell. Arg.

Thallus crustaceous, uniform, granular to warty, now and then lobed at the periphery, yellow to orange, not stained by KHO; apothecia sessile, circular, lecanorine, yellow; asci 8-sporous to multisporeous, the spores simple or bilocular; sterigma sparingly jointed; spermatia short, straight.

## KEY TO SPECIES.

- Thallus effuse, minutely squamulose; disk yellow..... 1. *C. vitellina*.  
 Thallus granulose, greenish yellow; disk grayish yellow..... 2. *C. cerinella*.

**1. Candelariella vitellina** (Ehrh.) Muell. Arg.

Thallus effuse, citrine yellow, of minute round and crenate, lobulate squamules; apothecia sessile; disk flat, concolorous with the thallus, the thalline margin entire or now and then finely crenulate; epithecium granulose, yellow; thecium colorless, with iodine blue, KHO—; paraphyses free, slightly clavate, some furcate and jointed below the tips; hypothecium colorless; asci inflated-clavate; spores 8, 10 to 16  $\mu$  long, 4 to 4.5  $\mu$  thick, simple and bilocular, the septum disappearing after KHO.

On barks, dead wood, rocks, and earth upon rocks. Common throughout the United States and Canada; Europe; South America (Bolivia); western Africa; Oceania.

**2. Candelariella cerinella** Zahlbr. in Engl. & Prantl, Nat. Pflanzenfam. 1<sup>1\*</sup>: 207. 1907.

*Lecanora cerinella* Floerke in Steud. & Hochst. Enum. Pl. Germ. Helv. 1826, nomen nudum.

Thallus thin, of greenish yellow, round granules, dispersed or crowded, KHO—, Ca (ClO)<sub>2</sub>—; apothecia sessile; disk plane or slightly convex, greenish yellow; thalline margin thin, crenulate; epithecium continuous, greenish yellow; thecium colorless, 44 to 80  $\mu$  high, blue with iodine; paraphyses strict, subcoherent, septate and clavate at the thickened and sometimes globular capitate tips; hypothecium yellowish or colorless; asci subinflated-clavate, the membrane thickened at top; spores 8, oblong-ellipsoid, 13 to 20  $\mu$  long, 5 to 7  $\mu$  thick, simple or faintly bilocular, some slightly curved.

On rocks and earth upon rocks. Palm Springs, Riverside County; in the Santa Monica Range on argillaceous shale; Yosemite Valley over moss on rocks. Perhaps generally distributed, but overlooked from its similarity to the preceding species.

**PARMELIACEAE.**

Thallus foliaceous, spreading or ascending, or sometimes fruticulose; gonidia Pleurococcus; apothecia circular with a thalline margin, sessile or subpedicellate; asci with 6 to 8 spores, rarely more.

## KEY TO GENERA.

- Apothecia on upper surface, sessile or subsessile..... *PARMELIA* (p. 99).  
 Apothecia mainly marginal or nearly so..... *CETRARIA* (p. 103).

**PARMELIA** Ach.

Thallus foliaceous, horizontally spreading, variously lobed, rarely ascending; apothecia cup-shaped with a thalline margin; spermogones imbedded; sterigmata loosely branching, septate, peculiarly and characteristically bayonet-shaped; spermatia short, straight; spores in 8's, rarely more, colorless, simple, from ellipsoid to almost globular.

Some of the species are not well defined in their gross external characters and a concise, brief description is difficult, therefore the chemical reactions are an important aid to determinations.



## KEY TO SPECIES.

Thallus loosely affixed, the lobes inflated.

Greenish gray above; lobes flattening at border..... 12. *P. physodes*.

Gray above; lobes linear and deeply cleft..... 13. *P. enteromorpha*.

Thallus closely affixed, horizontally expanded.

Thallus light colored.

Thallus light straw-colored or pale greenish.

Beneath black.

Small and narrowly lobed; with KHO + yellow..... 14. *P. subcapitata*.

Large and broadly lobed.

Thallus finely wrinkled; medulla with KHO + yellow, with  $\text{Ca}(\text{ClO})_2$ —.. 1. *P. cylisphora*.

Thallus smooth; medulla with KHO— with  $\text{Ca}(\text{ClO})_2$  + red..... 2. *P. olivetorum*.

Beneath dark but not black.

Broadly expanding.

Thallus with KHO + yellow; fruiting freely..... 3. *P. conspersa*.

Thallus with KHO —; sterile..... 4. *P. subconspersa*.

Not broadly expanding; lobes narrow..... 3a. *P. conspersa stenophylla*.

Thallus light gray.

Smooth above.

Lobes ascending; sterile with us..... 5. *P. perlata*.

Lobes less ascending, broadly laciniate; fruiting freely..... 6. *P. tiliacea*.

Reticulate-lacunose above..... 7. *P. saxatilis*.

Thallus dark brown.

Beset with concolorous small warts..... 10. *P. exasperata*.

Not beset with warts.

Slightly wrinkled above.

Spores more than 8..... 9. *P. multispora*.

Spores not more than 8..... 11. *P. glabra*.

Not wrinkled above, glistening..... 8. *P. olivacea*.

### 1. *Parmelia cylisphora* (Ach.) Wain.

Thallus orbicular, expanded, sometimes to a width of 20 cm., pale greenish yellow, interruptedly radiate, rugose, pulverulent, isidiose, except at the border lobes, these smooth, broadly laciniate, round-lobed, the periphery suberect, entire or crenate, beneath deep black, the periphery light brown, with short, black, dispersed rhizinae, smooth, with KHO both layers yellow,  $\text{Ca}(\text{ClO})_2$ =; apothecia rather rare, when present medium large, the largest barely 2 mm. wide; disk concave, red brown, with an erect, often pulverulent thalline margin; epithecium subcontinuous, sordid greenish yellowish; thecium 52 to 56  $\mu$  high, the lower half colorless; hypothecium colorless; asci inflated or cuneiform, 35  $\mu$  long, 16  $\mu$  thick; spores ovoid-ellipsoid, 10 to 16  $\mu$  long, 7 to 9  $\mu$  thick.

On boulders and dead and living bark. Santa Monica, San Gabriel, and Verdugo Mountains. North and South America; Europe; Hawaiian Islands.

### 2. *Parmelia olivetorum* (Ach.) Nyl.

Thallus pale greenish (a specimen determined by Nylander in 1898 now dusky yellow in the herbarium), orbiculate, widely spreading, from 5.5 to 12 cm. in width, laciniate-lobed, the laciniae contiguous and the border entire or coarsely round-crenate;



upper surface smooth or papillate, rugulose, in the center and at the border of the laciniae often with isidia of the same color with the thallus, beneath dark brown black, at the border brown and glistening; rhizinae few and short, with KHO cortex yellow, the medulla not stained, with  $\text{Ca}(\text{ClO})_2$  the cortex not stained, the medulla red.

On oak bark, canyons of the Santa Monica Range. Fruiting specimens have not been found. Determined by the late Dr. W. Nylander.

### 3. *Parmelia conspersa* (Ehrh.) Ach.

Thallus greenish straw color, orbicular-spreading, often extensively, appressed, laciniate-divided and lobate, the lobes and laciniae, except at the extreme margin, round-crenate, the center variously rugose, beneath dingy brownish blackish, with KHO the cortex yellow, the medulla yellow, then red,  $\text{Ca}(\text{ClO})_2=$ ; apothecia numerous, elevated-sessile; disk dark chestnut to almost black, concave to flat, with an incurved, crenulate thalline margin; epithecium continuous, colorless to dusky yellowish; thecium with a faint yellowish shade, 40 to 44  $\mu$  high; paraphyses coherent with slightly capitate tips; hypothecium colorless; asci clavate; spores 8, ovoid 8 to 12  $\mu$  long, 5 to 8  $\mu$  thick; all hymenial structures stained blue with iodine, KHO—.

Rocks and boulders, frequent throughout and often spreading extensively. North America to the Arctic; South America; Australia and Tasmania; Europe.

The forma *isidiata* Leight. has the upper surface thickly beset with concolorous isidia, excepting the extreme border, but is otherwise similar to the species with which it is found, though less frequently in fruit.

#### 3a. *Parmelia conspersa stenophylla* Ach.

Orbicular, less spreading, 3 to 5 cm. wide, appressed; laciniae narrow, almost linear, dilating at the border, more separate than in the species; sparingly fruiting.

On rocks; San Bernardino Mountains, *Parish*; occasional in the Santa Monica Range; frequent on clay and sand rock near Del Mar.

### 4. *Parmelia subconspersa* Nyl.

Thallus pale greenish straw color, orbicular, from 5 to 10 cm. wide, laciniate-lobate, the laciniae contiguous and subimbricated, the border more or less ascending, at the center the borders not seldom sorediate, beneath light brown to blackening, the rhizinae few and short; apothecia as in *P. conspersa*, to which it is very similar, differing only in the medulla not staining yellow with KHO. It is rarely found fruiting.

On boulders in the Santa Monica and San Gabriel Ranges with *P. conspersa* but less frequent.

### 5. *Parmelia perlata* (L.) Ach.

Thallus dilated, spreading, deep and wide-lobed, with entire or sublobulate border, smooth above, the lobes suberect, the margin often turgidly sorediate, beneath black with scattered, short rhizinae, at the border brown, smooth, somewhat glistening, with KHO the cortex deep yellow, the medulla yellow,  $\text{Ca}(\text{ClO})_2=$ ; apothecia not found in our district.

Rocks, bark, and earth. On earth, Santa Catalina Island, *Trask*; on twigs and earth at base of rocks in the Santa Monica Mountains; on trunks in the San Jacinto and San Gabriel Mountains. Northern United States to Mexico; South America; Polynesia; Australia; and Europe.

### 6. *Parmelia tiliacea* (Hoffm.) Ach.

Thallus whitish or faint cream color, deeply lobed, the lobes roundish-crenately cut, contiguous and imbricate; upper surface undulate in the center, flattening toward the circumference, irregularly orbiculate, moderately loosely affixed, beneath black, fibrillose, naked, smooth, and glistening at the border, with KHO the cortex yellow, the medulla unchanged, with  $\text{Ca}(\text{ClO})_2$  the cortex unchanged, the medulla red; apothecia sessile, 2 to 5.5 mm. wide, numerous and crowded at the center; disk reddish to chestnut, flat, undulate, the thalline margin entire or subcrenate, persistent;



epithecium continuous, pale reddish brown, gradually paling downward; thecium 68 to 72  $\mu$  high, colorless, with iodine blue, the epithecium retaining its natural color; paraphyses coherent; hypothecium of the same tint as the epithecium, but paler; asci clavate; spores 8, ellipsoid, 8 to 16  $\mu$  long, 5 to 8  $\mu$  thick.

On various barks. Oaks in the Yosemite valley, the lobes small and closely adherent; canyons of the San Gabriel Mountains; San Jacinto Mountains (Strawberry Valley) at 1,600 meters. Rarely on rocks. San Diego, *Alderson*, and in San Antonio Canyon, San Gabriel Range. Common in North America; Mexico; South America; Europe, Asia, and Africa.

**7. *Parmelia saxatilis* (L.) Ach.**

Thallus orbiculate, light grayish or pale yellowish gray, comparatively narrowly lobate-laciniate, the laciniae short, sinuate, smoothish or shallow-lacunose, beneath smooth, black, glistening, with few rhizinae, with KHO the cortex yellow, the medulla red, with  $\text{Ca}(\text{ClO})_2$ —; fruiting specimens not seen.

On moss-covered rocks at base of trees and among moss on earth in the San Gabriel Range at 1,600 meters altitude.

**8. *Parmelia olivacea* (L.) Ach.**

Thallus orbicular, appressed, brown to dark brown, deeply laciniate-lobed, the lobes imbricate at the center, then contiguous or at the circumference becoming somewhat discrete, the margin crenately cut, smooth and more or less glistening above, KHO—,  $\text{Ca}(\text{ClO})_2$ —; beneath dark with dark fibrils; apothecia often numerous at the center, sessile, 0.5 to 2 mm. wide; disk concave, concolorous with the thallus or reddish brown, glistening; thalline margin thin, almost entire to crenulate; epithecium subcontinuous, yellowish brown; thecium 60 to 64  $\mu$  high, colorless; paraphyses coherent; hypothecium colorless; asci inflated-clavate; spores 8, ovoid-ellipsoid, 8 to 11  $\mu$  long, 6 to 8  $\mu$  thick; sterigma articulate, branching; spermatia straight, 8 to 12  $\mu$  long and apparently 1  $\mu$  thick.

On barks and rocks; common and variable throughout our mountains, ascending from the plains. San Bernardino, *Parish*; Santa Cruz Mountains, *Herre*.

**9. *Parmelia multispora* A. Schneid.**

Thallus orbicular, closely appressed to smooth bark of trees and twigs (and dead wood), the border roundish, entire or incised, KHO=,  $\text{Ca}(\text{ClO})_2$ —, beneath dark with short black fibrils, brown and devoid of fibrils at the border; disk brown, flat-concave, now and then rugose-verruculose; thalline margin entire, finally obscure; epithecium continuous, brown, gradually paling downward; thecium 60 to 64  $\mu$  high, stained blue with iodine, except the epithecium, this not affected by the reagent; paraphyses coherent; hypothecium colorless; asci inflated-clavate; spores 16 to 24 in ascus (50 to 100, as stated by Schneider, not observed), ovoid, from 8 to 9  $\mu$  long, 5 to 8  $\mu$  thick, or globular and from 6 to 8  $\mu$  in diameter.

The thallus differs from that of *P. olivacea* in being less spreading. Spermatogones not seen.

San Bernardino Mountains, *Parish*; on shrubs in the Santa Monica and San Gabriel ranges, not infrequent.

**10. *Parmelia exasperata* (Ach.) Nyl.**

Thallus orbicular, brown, densely beset above with erect, concolorous papillae, the lobes narrower than in *P. olivacea*, in typical forms only the ends of the laciniae crenulate and free of papillae, KHO—,  $\text{Ca}(\text{ClO})_2$ —, beneath dark with short dark rhizinae; apothecia sessile, disk concave to flat and undulate, of the color of the thallus; thalline margin persistent, entire or finely crenulate and with papillae; epithecium continuous, pale yellowish brownish, overlaid by a thin hyaline membrane; lower half of thecium colorless; paraphyses coherent; hypothecium colorless; asci clavate, 40  $\mu$  long, 10 to 12  $\mu$  thick; spores 8, ovoid, 8 to 10  $\mu$  long, 5 to 6  $\mu$  thick; hymenial gelatine and asci bluish with iodine, the epithecium and hypothecium not affected, KHO—.



On barks and rocks with *P. olivacea*, perhaps less frequent. San Bernardino Mountains, *Parish*.

#### 11. *Parmelia glabra* Schaer.

Thallus orbiculate, closely affixed, from olive green darkening to umber brown, radiately folded or undulate, the surface wrinkled, becoming smooth at the deeply lobed circumferences, the border crenate, medulla KHO—,  $\text{Ca}(\text{ClO})_2$ +red; apothecia scattered or crowded centrally, sessile; disk concave to flat and undulating; thalline margin erect, coarsely crenate; epithecium continuous, light yellowish brown; thecium colorless,  $60\ \mu$  high, blue with iodine, the epithecium and hypothecium not staining, however; paraphyses loosely coherent; hypothecium colorless; asci clavate; spores 8, ovoid,  $14$  to  $18\ \mu$  long,  $7.5$  to  $10\ \mu$  thick.

On barks. San Antonio Canyon, San Gabriel Range at 1,600 meters altitude and at "Seven Oaks," San Bernardino Mountains.

#### 12. *Parmelia physodes* (L.) Ach.

Thallus light greenish gray, stellate-orbiculate, loosely affixed, radiately divided, tubular, subinflated, somewhat flattened, with KHO the cortex yellow, the medulla not affected, with  $\text{Ca}(\text{ClO})_2$ =; epithecium continuous, hyaline; thecium sordid yellowish, with iodine indigo blue, KHO—; paraphyses coherent; hypothecium colorless; asci inflated-clavate or cuneiform; spores 8, globular and ovoid-ellipsoid,  $4$  to  $7.5\ \mu$  long,  $4\ \mu$  thick; apothecia subpedicellate; disk chestnut-colored, with an inflated thalline margin.

Sparingly on barks in the San Gabriel Range. Eastern United States and northward; Pacific Coast; Tasmania; Europe.

#### 13. *Parmelia enteromorpha* Ach.

Thallus suberect, deeply divided, the linear divisions tubular-inflated, laciniately parted, whitish gray to gray above, their black margin passing into black beneath, KHO+yellow, the medulla KHO+ $\text{Ca}(\text{ClO})_2$ +red; apothecia sessile or subpedicellate, inflated, funnel-shaped; disk chestnut, glistening, flat becoming convex, the crenulate, slightly inflexed thalline margin then obscure; epithecium continuous, reddish, paling downward; thecium  $40$  to  $44\ \mu$  high; the lower part colorless; paraphyses coherent; hypothecium colorless; asci clavate; spores 8, subglobular,  $5$  to  $8\ \mu$  long,  $4$  to  $6\ \mu$  thick, the gonidial layer continuing beneath the hypothecium; spermatogonia indicated as black, generally frequent dots.

Frequent on shrubs and trees in the mountains. Santa Catalina Island, *Trask*; San Bernardino Mountains, *Parish*; Lower California, *Orcutt*; Guadalupe Island, very luxuriant,  $15\ \text{cm.}$  in diameter, *Franceschi*.

#### 14. *Parmelia subcapitata* Nyl.

Thallus as seen small, orbicular, pale straw color, closely adherent, centrally isidiose, at the periphery laciniate-lobed, beneath black, with KHO the cortex yellow, the medulla unchanged, KHO+ $\text{Ca}(\text{ClO})_2$ —, sterile.

On twigs at San Diego, *Alderson* (communicated by S. B. Parish). Determination by the late Doctor Stizenberger. The sterile specimen is too fragmentary to allow a full description.

### CETRARIA Ach.

Thallus foliaceous with ascending lobes or fruticulose; apothecia marginal or terminal, circular with a thalline margin; spores colorless, small, simple, ovoid to ellipsoid; gonidia Protococcus; sterigma sparingly branched, short; spermatia ellipsoid to clavate.

#### KEY TO SPECIES.

Thallus foliaceous.

- |                                |                           |
|--------------------------------|---------------------------|
| Yellow.....                    | 1. <i>C. juniperina</i> . |
| Green or a shade of green..... | 2. <i>C. lacunosa</i> .   |



Thallus fruticulose, dark.

- Compressed throughout. . . . . 4. *C. saepincola*.  
 Branches subterete. . . . . 3. *C. californica*.

1. *Cetraria juniperina* (L.) Ach.

Thallus a rich chrome yellow, foliaceous, erect or suberect, about 0.5 cm. high, the lobes longitudinally furrowed and slightly lacunose, lacerate at the edges; apothecia adnate, submarginate on the upper surface; disk brown, concave, shining; thalline margin persistent, crenulate; epithecium yellowish brown, sharply defined below; thecium 52 to 56  $\mu$  high, the upper part pale yellowish tinted; paraphyses adglutinate, ill defined, with small yellow heads; hypothecium colorless; asci oblong-clavate, the membrane thickened above; spores 8, ovoid-ellipsoid, 8 to 9  $\mu$  long, 4.5 to 5.5  $\mu$  thick; hymenial gelatine blue with iodine, soon changing to brownish, a narrow hyaline border of the epithecium remaining unaffected.

On barks. Monterey Bay, *Herre*; dead limbs of conifers at Wauwona, in the Sierra Nevada. Throughout the eastern United States to arctic America; Europe.

2. *Cetraria lacunosa* Ach.

Thallus foliaceous, grayish green, lacunose-rugulose, deeply parted from the base, the lobes subascending, dilated outward and the border lacerate-laciniate, beneath whitish, in places blackening; apothecia terminal; disk brown, at last planoconvex and rugulose; thalline margin thin, entire; epithecium continuous, pallid flesh-colored or pale brown, paling below; thecium 48 to 50  $\mu$  high; paraphyses loosely adglutinate; hypothecium colorless; asci clavate; spores 8, ovoid-ellipsoid, 8 to 8.5  $\mu$  long, 4.5 to 5  $\mu$  thick; thallus with KHO=; hymenial gelatine with iodine pale blue, soon greenish, then sordid brown; spermatia ellipsoid, 3 to 4  $\mu$  long, 1  $\mu$  thick.

On pines, Squirrel Inn, San Bernardino Mountains, *Reed*.

3. *Cetraria californica* Tuck.<sup>1</sup>

Thallus fruticulose, suberect and erect, greenish brown to almost black, paler beneath, the lobes terete-compressed, lacunose and longitudinally furrowed, soon intricately branching up to the finely lacerate termination; apothecia terminal and subterminal, 2 to 5 mm. wide, subpedicellate; disk concave to planoconvex, concolorous with the thallus; thalline margin thin, crenulate and finally almost obsolete; epithecium continuous, a thin brown band; thecium 80  $\mu$  high, pallid, staining blue with iodine, except the epithecial border (20  $\mu$  wide), this not affected; paraphyses coherent; hypothecium colorless; asci inflated-clavate, with iodine darker blue than the other parts; spores 8, ellipsoid, 10 to 11  $\mu$  long, 4.5 to 5  $\mu$  thick; blue stain gradually changing to light brown, after KHO the paraphyses appearing indistinctly septate.

On living or dead shrubs and limbs of trees, preferably conifers. Rare in the Santa Monica Range, but frequent in the higher ranges.

4. *Cetraria saepincola* (Ehrh.) Ach.

Thallus grayish green to almost black, suberect to erect, 0.5 to 0.75 cm. high, irregularly laciniate-lobate, paler beneath, KHO—, Ca(ClO)<sub>2</sub>—; apothecia adnate, marginal and lateral; disk concave to flat, green black to black, glistening as if varnished; thalline margin entire, persistent; epithecium continuous, brownish yellowish, paling downward; thecium 36 to 40  $\mu$  high, colorless below; paraphyses adglutinated; hypothecium of a paler hue than the epithecium; asci clavate; spores 8, 9 to 12  $\mu$  long, 6 to 8  $\mu$  thick; with iodine the epithecium not stained, the other thecial structures blue.

<sup>1</sup>Dr. R. Heber Howe, jr., in his *Classification de la Famille des Usneaceae dans l'Amérique du Nord* (p. 20, Paris, 1912) transposes *Cetraria californica* to the genus *Coelocaulon* Link as *Coelocaulon californicum* (Tuck.) Howe.



On limbs of conifers in the Tehachapi, San Gabriel, and San Jacinto ranges. Northern United States to arctic America; Europe; mountains of northern and middle Asia; Auckland and New Zealand.

The variety *chlorophana* Wahlenb. (Santa Cruz Mountains, *Herre*), has not been reported from our district.

### USNEACEAE.

Thallus fruticulose, erect to pendulous and elongate-pendulous, terete, terete-compressed, and foliaceous-compressed, corticate throughout, affixed to the substratum by a common basal plate; apothecia circular, shield or dish-shaped, lecanorine; spores from solitary to 8, colorless, simple or bilocular in our species; gonidia Protococcus.

#### KEY TO GENERA.

- Spores bilocular; thallus light straw or pale greenish, compressed-foliaceous or terete-compressed..... *RAMALINA* (p. 105).  
 Spores simple.  
   Thallus brown to black..... *ALECTORIA* (p. 109).  
   Thallus of some lighter color.  
     Thallus rich yellow..... *LETHARIA* (p. 110).  
     Thallus pale greenish.  
       Compressed, linear, sterile with us..... *EVERNIA* (p. 109).  
       Terete..... *USNEA* (p. 108).

### RAMALINA Ach.

Thallus fruticulose, erect or pendulous, affixed by a basal plate to the substratum, branching, seldom nearly foliaceous, terete or subcompressed, corticate throughout; gonidia Protococcus; soredia not rare; apothecia terminal or lateral, cup-shaped or shield-shaped, lecanorine; spores 8, colorless, oblong, ellipsoid to fusiform, straight or lightly curved, bilocular, rarely quadrilocular; sterigma sparingly branched; spermatia short, straight.

#### KEY TO SPECIES.

- Laciniae long-pendulous, fenestrate..... 11. *R. reticulata*.  
 Laciniae erect or nearly so.  
   Terete or subcompressed.  
     Apothecia lateral..... 1. *R. ceruchis*.  
     Apothecia terminal or subterminal..... 2. *R. combeoides*.  
   Compressed.  
     Rigid..... 3. *R. homalea*.  
     Not rigid.  
       Linear-elongate.  
         Canaliculate..... 4. *R. canaliculata*.  
         Not canaliculate, flat.  
           Margins of laciniae sorediate..... 6. *R. farinacea*.  
           Margins not sorediate..... 5. *R. fraxinea*.  
           Beset with black fibrils..... 9. *R. crinita*.  
           Not beset with fibrils.  
             Irregularly branching; apothecia  
               marginal..... 10. *R. menziesii*.  
             Branching at base, furcate at tips;  
               apothecia lateral..... 8. *R. yemensis*.  
       Not linear-elongate, dilated, lacerate, and sorediate  
         above.  
         Low, not over 2 cm. high..... 7. *R. pollinaria*.  
         Taller, 4 to 5 cm. high..... 12. *R. evernioides*.



**1. *Ramalina ceruchis* (Ach.) De Not.**

Thallus tufted, pale straw color, terete becoming often somewhat angular from shallow lacunæ, frequently with small black dots, attenuate upward, often with few short branches above, KHO+ pale yellow, Ca(ClO)—; apothecia lateral and subterminal, 1 to 2 mm. wide; disk concave, delicately whitish pruinose, the thalline margin entire or slightly crenulate; spores 8, oblong, straight or lightly curved, 13 to 20  $\mu$  long, 4 to 5  $\mu$  thick, bilocular.

Not rare along the coast on shrubs; San Clemente Island, *Trask*.

In the forma *cephalota* Tuck. the sterile thallus is besprinkled with cephaloid, isidiose spots and excrescences. It is found with the species. San Clemente Island, *Trask*.

**2. *Ramalina combeoides* Nyl.**

Thallus tufted, sordid light yellowish, subterete, appearing angular from the numerous lacunæ, no reaction of the cortex or medulla with KHO or Ca(ClO)<sub>2</sub>, 1 to 2 cm. in height; apothecia terminal and subterminal, usually several clustered at or below the apex, 2 to 7 mm. wide; disk concave to flattish, pale ochroleucous, the thalline margin entire or crenately cut; spores straight or very lightly curved, 12 to 20  $\mu$  long, 3.5 to 5  $\mu$  thick.

On rocks and shrubs near the coast and on the coast islands; San Clemente Island, *Trask*; on shrubs near San Diego and Newport.

A form occurs near Clifton-by-the-Sea, Los Angeles County, on dead *Sambucus* and *Isomeris arborea*, having the thallus and the thalline margin of the apothecia thickly studded with globular, ochroleucous bodies, their cortical membrane, 28 to 32  $\mu$  thick, composed of compact vertical hyphæ, passing below into a coarse-celled tissue; the cortex containing small gonidia (yellow with KHO), 6 to 12  $\mu$  in diameter, shriveled and distorted; the apothecia, clustered at the apices of the erect thallus tufts, containing oblong spores, mostly straight, 8 to 14  $\mu$  long, 3.5 to 4  $\mu$  thick; all apothecial structures staining blue with iodine.

**3. *Ramalina homalea* Ach.**

Thallus tufted, strongly compressed, 2-edged, sordid light yellowish gray (becoming reddish brown in the herbarium), the surface shallow-lacunose and reticulate-ridged, 3 to 8 cm. high, the sterile fronds gradually attenuating upward, the fertile mostly shorter and wider (0.5 to 2.5 mm. wide), no reaction of thallus or medulla with KHO or Ca(ClO)<sub>2</sub>; apothecia marginal and terminal, 2 to 8 mm. wide; disk pale buff, velvety, concave to flat, finally everted and distorted; thalline margin persistent, stout, entire to slightly sinuate; spores straight; 14 to 18  $\mu$  long, 4 to 5  $\mu$  thick.

Near the coast; Santa Barbara and San Clemente Islands, *Trask*; San Guadalupe Island, *Franceschi*; Santa Catalina Island

**4. *Ramalina canaliculata* Fries.**

Laciniae of the tufted thallus narrow, linear, canaliculate, 3 to 6 cm. high, without soredia, sparingly branching, ascending to erect, glaucous, pale green; apothecia subterminal below the deflected points of the laciniae, small to medium large; disk concave, round, often saddle-shaped, lightly pruinose, the thalline margin persistent, mostly entire; spores bilocular, 12 to 16  $\mu$  long, 4 to 7  $\mu$  thick.

On shrubs and branches of trees throughout the Santa Monica Range; Lower California, *Brandegge*.

**5. *Ramalina fraxinea* (L.) Ach.**

Thallus tufted, the laciniae broader and longer than in *R. calicaris*, flat, simple or sparingly divided, not finely attenuate above; upper surface deeply lacunose, now and then fenestrate, or at last loosely fringed with linear, laciniolate lobules; apothecia hitherto not found.

Santa Catalina and Santa Barbara islands, *Trask*.



**6. *Ramalina farinacea* (L.) Ach.**

Erect or pendulous, light yellowish or grayish greenish, early dividing into narrow, linear, flattish, faintly longitudinally lacunose laciniae, gradually acuminate above, the margin beset with an almost continuous row of soredia; apothecia (rare) marginal, subpedicellate, not over 1.5 mm. wide, the tips not deflected above the apothecia; disk concolorous, concave; thalline margin finally obsolescent; spores oblong-ellipsoid, straight or lightly curved, 13 to 17  $\mu$  long, 6 to 7  $\mu$  thick.

Frequent throughout on bushes, trees, and fences. Common in North America and Europe.

**7. *Ramalina pollinaria* Ach.**

Thallus tufted, erect, flaccid, pale greenish and pale greenish gray, about 2 cm. high, the laciniae compressed, longitudinally furrowed, glaucescent, narrowing and laciniately cleft into linear lobes above, the larger bursting into sorediate lobules; apothecia not found.

On bushes and branchlets of trees in canyons of the Santa Monica Range.

**8. *Ramalina yemensis* (Ach.) Nyl.**

A sterile specimen collected by Mr. S. B. Parish at Leche Creek, San Bernardino Mountains, has been determined as such by Doctor Stizenberger. It is 2 to 2.5 cm. high, tufted, flaccid, the laciniae compressed, minutely lacunose and longitudinally furrowed, dichotomously divided, the narrowed ends furcate; some of the laciniae with semiglobular black brown tubercles, composed of loose hyphae and brown granular matter; spermogones not seen. The plant is very similar to *Evernia prunastri*.

**9. *Ramalina crinita* Tuck.**

Erect or subpendulous, generally densely tufted, compressed, linear-laciniate to broadly linear, the laciniae deeply divided, both surfaces alike, shallow-furrowed, longitudinally lacunose and occasionally fenestrate, the margins of the laciniae loosely beset with black, long, simple or forked fibrillae, the cortex or medulla giving no reaction with KHO or  $\text{Ca}(\text{ClO})_2$ ; apothecia lateral and subterminal, in the latter case the tip of the lacinia deflexed immediately above the apothecium, subpedicellate, 3 to 8 mm. wide; disk concolorous, concave, then flat and undulate; thalline margin persistent, entire, at first concolorous, later darkening; epithecium continuous, sordid pale yellowish greenish; thecium colorless, 44 to 56  $\mu$  high; paraphyses coherent; asci clavate, 40  $\mu$  long, 10  $\mu$  thick; spores 8, straight and curved, 12 to 16  $\mu$  long, 3.5 to 4  $\mu$  thick; all hymenial structures blue with iodine.

On shrubs, Lower California; on *Euphorbia misera*, near San Diego, Orcutt; on *Lycium californicum*, Point Loma, near San Diego. The laciniae are from 2 to 10 cm. in length.

**10. *Ramalina menziesii* Tuck.**

Thallus tufted, erect or pendulous, rigid, the laciniae linear, sparingly divided above, shallow-lacunose and furrowed lengthwise, attaining a length of from 3 to 6 and 8 cm., neither cortex nor medulla giving reaction with KHO or  $\text{Ca}(\text{ClO})_2$ ; apothecia sessile and pedicellate, marginal, from 2 to 7 mm. wide; disk pale ochroleucous, concave to flat, saddle-shaped and recurved; thalline margin erect, subentire, at last obsolescent; epithecium faint yellow, granulose; thecium 52  $\mu$  high, blue with iodine; paraphyses adglutinate, strict; hypothecium thin, colorless or faint yellowish; asci inflated-clavate; spores 8, 12 to 18  $\mu$  long, 3.5 to 7  $\mu$  thick, oblong, slightly curved, bilocular.

Frequent on shrubs and branches of trees, ascending the mountains to about 800 meters.

The typical plant has flat, compressed laciniae, reticulate with shallow ridges; but there occurs a form with glaucous thallus, without reticulation, but canaliculate, a transition to *canaliculata* as it were.



**11. *Ramalina reticulata* (Noehd.) Kremp.**

Pale green, compressed, pendulous in festoons from limbs of trees, often 1 meter in length or even more, ramifying, the laciniae smooth or furrowed, lacunose and fenestrate, forming an extensive network; apothecia marginal and lateral, sessile; disk concave to flat and the thalline margin then obsolete; epithecium subcontinuous, yellowish; paraphyses coherent; hypothecium colorless; spores 8, 14 to 18  $\mu$  long, 4 to 7  $\mu$  wide, oblong, straight or slightly curved, bilocular; spermogones numerous in the dilated fronds as small protuberances of the color of the thallus; sterigma straight or a little curved and fastigate as it were; spermatia short, straight, 4 to 6  $\mu$  long; KHO giving no reaction.

Frequent in canyons along the coast.

**12. *Ramalina evernioides* Nyl.**

Thallus compressed, suberect or subpendulous, both surfaces flattened, reticulate-lacunose, smoother above, from a broad base soon dividing into laciniae, these irregularly sinuate and laciniate in the upper part, the laciniae often marginally sorediate-torn, 1 to 2.75 cm. high, the cortical hyphae perpendicular to the thalline axis, beneath the cortex the well developed layer of longitudinal hyphae containing the gonidia; fruiting plants hitherto not found.

On shrubs at Point Loma, near San Diego, and also at Newport, Orange County.

**USNEA (Dill.) Adans.**

Thallus fruticulose, filamentose, erect or pendent, often much elongated, terete, branching, smooth or the cortex beset with tubercles or short diverging fibrillae; apothecia circular, the lecanorine margin often ciliate; spores acicular to fusiform.

**KEY TO SPECIES.****Thallus erect.**

- |                             |                          |
|-----------------------------|--------------------------|
| Grayish green, bearded..... | 1. <i>U. hirta</i> .     |
| Reddish, bearded.....       | 2. <i>U. rubiginea</i> . |

**Thallus pendulous.****Cortex fibrillose.**

- |                               |                         |
|-------------------------------|-------------------------|
| Densely short-fibrillose..... | 3. <i>U. ceratina</i> . |
| Loosely short-fibrillose..... | 4. <i>U. dasypoga</i> . |

- |   |                           |
|---|---------------------------|
| Cortex not fibrillose, fissured transversely; smooth..... | 5. <i>U. articulata</i> . |
|---|---------------------------|

**1. *Usnea hirta* (L.) Hoffm.**

Thallus erect, cespitose, dull grayish green or light green, hardly above 3 cm. high, much branched and thickly bearded with short fibrils, sorediate; always sterile.

Common on fences and bushes of the foothills and ascending the mountains. At Del Mar on twigs; Santa Catalina Island, *Trask*.

**2. *Usnea rubiginea* (Michx.) Herre, Proc. Washington Acad. Sci. 7: 343. 1906.**

*Usnea florida rubiginea* Michx. Fl. Bor. Amer. 2: 332. 1803.

Very similar to *U. hirta* and also sterile, but reddish-colored. Of the same distribution and habitat, but less frequent.

**3. *Usnea ceratina* Ach.**

Thallus dusky yellowish green, pendulous, elongated, shortly and more or less densely fibrillose, except at the extremely attenuate terminations, but these, as throughout, besprinkled with small soredia; sterile.

On shrubs, Santa Catalina Island, *Trask*; Santa Cruz Mountains in fruit, *Herre*. Not common with us.

**4. *Usnea dasypoga* (Ach.) Nyl.**

Similar to *U. ceratina*, but less stout and sparingly beset with fibrillae and soredia, pendent, attaining a length of 20 cm.; also sterile.

On shrubs in the San Gabriel Range.



**5. *Usnea articulata* (L.) Hoffm.**

Pendulous, light yellowish grayish green; primary divisions terete, smooth, the continuity of the cortex interrupted by annular fissures; sterile.

On *Abies*, "Grass Valley," San Bernardino Mountains, *Parish*. Apparently rare.

**ALECTORIA Ach.**

Thallus filamentous, pendulous, rarely ascending, elongated, smooth, corticate throughout; apothecia lateral, pedicellate, rare with us.

**KEY TO SPECIES.**

Erect; apothecia with fibrils..... 2. *A. oregana*.

Pendulous, smooth.

Terete, dark brown..... 1. *A. jubata*.

Compressed-terete, straw color..... 3. *A. ochroleuca*.

**1. *Alectoria jubata* (L.) Ach.**

Thallus long-pendulous, dark brown throughout, terete, smooth and glistening, lacunose below, much branched and the capillary terminations intertangled, KHO—; apothecia rare, sessile, lateral; disk concolorous with the thallus, convex and the thalline margin becoming obsolete; epithecium continuous, brown; thecium 36 to 40  $\mu$  high, pale reddish brown or the lower half colorless; paraphyses coherent; hypothecium colorless; asci clavate; spores 8, ovoid-ellipsoid, 6 to 8.5  $\mu$  long, 4 to 4.5  $\mu$  thick; all apothecial structures with iodine blue, KHO—.

On branches of conifers, San Quentin, Lower California, *Greene*. Upon the same substratum in the San Jacinto and San Bernardino Mountains, but generally sterile.

**2. *Alectoria oregana* Tuck.**

Thinly tufted, brown and dark brown, erect, subcompressed, lightly furrowed, sparingly branched or short, brown-fibrillose, the terminations terete, 1.5 to 3 cm. in height, KHO—; apothecia lateral and subterminal; disk dark brown, concave to plane, glistening; thalline margin with brown, short, spreading or deflexed fibrils; epithecium continuous, light brown; thecium colorless, 48 to 52  $\mu$  high; paraphyses coherent; hypothecium colorless; asci clavate, the tops thickened; spores 8, subglobular, 5 to 6  $\mu$  long, 3.5 to 4  $\mu$  thick; all hymenial structures staining blue with iodine, KHO—; the cortical membrane with longitudinal, sparingly branching hyphæ, those of the medulla freely branching, forming a loosely intertangled network.

On bark of conifers and dead wood. Along the west coast from Washington, *Foster*, to Cape San Quentin, Lower California, *Greene*. Not rare in the Tehachapi Range; at Strawberry Valley, San Jacinto Mountains; in the San Bernardino and San Gabriel Ranges.

**3. *Alectoria ochroleuca* (Ehrh.) Nyl.**

Pale straw color, compressed-terete, branched, the branches somewhat tortuous and interwoven, loosely beset with rather short lateral fibrils; specimen seen sterile, esorediate.

Determined by Doctor Stizenberger.

San Bernardino Mountains, *Parish*.

**EVERNIA Ach.**

Thallus fruticulose, erect or subpendulous, branching, variously lobed; apothecia lateral or subterminal; sterigma jointed, sparingly branched; spermatia acicular, straight.



**1. Evernia prunastri (L.) Ach.**

Thallus soft, pliant, compressed, pale whitish green above, beneath white-channeled longitudinally, divaricately branching, the ultimate divisions linear or often forked at the ends; fruiting specimens thus far not found.

The margins of the laciniae are more or less sorediiferous, and when the soredia are continuous it is the forma *sorediifera* Ach., though its limitation seems a matter of opinion.

Quite common in our district on shrubs and trees, on the mainland as on the islands of the archipelago.

**LETHARIA (T. Fries) Zahlbr.**

Thallus citrine yellow, flattened-terete, fruticulose, branching; medulla loose-webby, irregularly traversed by strengthening cords.

A single species with us.

**1. Letharia vulpina (L.) Wain.**

Fruticulose, erect, about a span high, though oftener not attaining that height, yellow or greenish yellow, terete or subcompressed, lacunose and furrowed; apothecia terminal and subterminal; disk concave to flat, red brown to blackish brown, from 0.5 to 2 or even 3.5 cm. in diameter, the frequently radiately fibrillose thalline margin finally obsolete; spores ovoid-ellipsoid, 5 to 8  $\mu$  long, 4.5 to 5  $\mu$  thick.

With us mostly on conifers, living or dead, rare below 1,500 meters. Mountains of Lower California, *Greene*. Pacific coast and the Rocky Mountains; Europe.

**CALOPLACACEAE.**

Thallus crustaceous, uniform or lobed at the periphery, or reduced-fruticulose; gonidia Protococcus; apothecia circular, innate or sessile, lecanorine or biatorine; spores colorless, polari-bilocular, seldom quadrilocular or simple; sterigma jointed; spermatia short, straight, oblong or ellipsoid.

**KEY TO GENERA.**

- Apothecia biatorine or lecideine; margin without gonidia. . . BLASTENIA (p. 110).  
Apothecia lecanorine. . . . . CALOPLACA (p. 112).

**BLASTENIA Mass.**

Thallus crustaceous, uniform, pulverulent or rimose; apothecia innate or sessile, with a proper margin; asci 4 to 16-spored; spores colorless, ellipsoid or oblong, polari-bilocular, rarely quadrilocular or simple; sterigma short, straight, rarely acicular or bowed.

**KEY TO SPECIES.****Substratum bark.**

- Thallus gray, chinky. . . . . 1. *B. ferruginea*.  
Thallus whitish, granulose. . . . . 1b. *B. ferruginea wrightii*.

**Substratum mineral.****Substratum earth.**

- Apothecia rusty orange, small. . . . . 4. *B. subpyraceella*.  
Apothecia bright orange to vermilion . . . . . 3. *B. luteominia*.

**Substratum rock.**

- Thallus obsolescent or absent. . . . . 2. *B. festiva*.

**Thallus present.****Ochraceous, poorly developed.**

- Apothecia bright vermilion. . . . . 1a. *B. ferruginea bolanderi*.  
Apothecia rusty orange. . . . . 4. *B. subpyraceella*.

- Whitish, pulverulent. . . . . 1c. *B. ferruginea fraudans*.



**1. *Blastenia ferruginea* (Huds.) Arnold.**

Thallus determinate or subdeterminate, greenish ash-colored or pale gray, coarsely granular to verruculose and chinky; hypothallus black, more or less distinct; thallus KHO+ purple; apothecia sessile, 0.25 to 0.75 mm. wide; disk flat to lightly convex, rusty red, KHO+ purple; proper margin thin, persistent, entire or nearly so; epithecium subgranulose, yellow to orange; thecium colorless, 88 to 100  $\mu$  high; paraphyses separate with yellowish bulbous heads; hypothecium pallid, yellow; asci clavate; spores 8, ellipsoid and oblong-ellipsoid, 14 to 20  $\mu$  long, 6 to 10  $\mu$  thick, polari-bilocular with an isthmus.

On various barks, rocks, and (rarely) earth; Santa Catalina Island on bark and rocks, in the Santa Monica Range on the same substrata and on earth.

**1a. *Blastenia ferruginea bolanderi* (Tuck.) Herre, Proc. Washington Acad. Sci. 12: 228. 1910.**

*Placodium ferrugineum* forma *bolanderi* Tuck. Syn. N. Amer. Lich. 1: 178. 1882.

Thallus thin, sordid pale greenish gray, effuse or absent, KHO—, Ca(ClO)<sub>2</sub>—; hypothallus indistinct; apothecia small, from 0.25 to seldom as much as 1.5 mm. in diameter; disk flat, later convex, bright crimson or often a handsome vermilion color; proper exciple concolorous with the disk or a little lighter, obsolescent in the larger apothecia; disk with KHO dark crimson; epithecium granulose, scarlet, thick, gradually paling downward; thecium 88 to 92  $\mu$  high, colorless, with iodine of an intense blue, including all the hymenial structures, KHO+carmine red or violet blue; paraphyses subcoherent, septate above and faintly colored at the rounded tips; hypothecium colorless or faintly yellowish tinted; asci clavate, the upper third of membrane thickened and the cavity attenuated to a neck above; spores 8, oblong-ellipsoid, approaching subfusiform, straight or some lightly curved, polari-bilocular; the cells approximate, 20 to 27  $\mu$  long, 6 to 8  $\mu$  thick.

On rocks, rarely on clay. Frequent in the Santa Monica Range but not collected in the higher mountains. It may be deserving of the rank of a species.

**1b. *Blastenia ferruginea wrightii* (Tuck.).**

*Placodium ferrugineum wrightii* Tuck. Syn. N. Amer. Lich. 1: 178. 1882.

Thallus crust medium thick, white, granular or obscurely scaly, subdeterminate with an indistinct, dark gray hypothalline border, KHO—; apothecia sessile, from 0.25 to 0.8 mm. wide, KHO+purple; disk dull rust color becoming finally convex; proper margin entire, persistent; epithecium subgranulose, reddish orange or deep orange red, gradually paling downward; thecium colorless below; paraphyses subcoherent; hypothecium colorless; asci clavate; spores broadly ellipsoid, polari-bilocular with an isthmus, 12 to 18  $\mu$  long, 6 to 8.5  $\mu$  thick.

On bark, Santa Catalina Island, *Trask*.

**1c. *Blastenia ferruginea fraudans* (T. Fries).**

*Caloplaca ferruginea fraudans* T. Fries, Vet. Akad. Handl. Stockholm 7: 27. 1867.

Thallus white, thin, effuse, or absent, KHO+ gradually crimson, the reaction appearing slower than upon the disk; apothecia sessile, crowded, small, 0.25 to 1.25 mm. wide; disk pale orange and yellowish orange, flat to convex, the proper margin paler, thin, yellowish, entire, a thin white thalline margin seen in juvenile apothecia but finally disappearing; disk and margins with KHO crimson; epithecium granulose, pale yellow; thecium colorless, 56 to 68  $\mu$  high, this and the epithecium blue with iodine; paraphyses loose, comparatively stout, some with globular pale yellow heads, others barely thickened and colorless at top; hypothecium colorless; asci clavate; spores 8, oblong-ellipsoid, 10 to 15  $\mu$  long, 3 to 5  $\mu$  thick, bilocular or polari-bilocular, the loculi approximate, the isthmus indistinct; epithecium and hymenium with KHO crimson.

On bleached whalebones, San Clemente Island, *Trask*; on arenaceous shale at "White Point" near San Pedro.



**2. *Blastenia festiva* (Fries).**

*Parmelia ferruginea festiva* Fries, Lich. Eur. Ref. 172. 1851.

Thallus as described "thin, grayish or dark . . . often evanescent," with us absent; apothecia sessile, somewhat larger than in *B. ferruginea*, 0.5 to 1 mm. wide; disk flat soon slightly convex, bright orange and darkening to rusty red; proper margin persistent, entire or crenulate; epithecium subcontinuous, yellow, narrow, its lower border well defined, after KHO purple; thecium 100 to 104  $\mu$  high, colorless, with iodine deep blue; hypothecium sordid yellowish; asci clavate or oblong-ellipsoid; spores oblong-ellipsoid, blunt-ended, 16 to 20  $\mu$  long, 5 to 7  $\mu$  thick, polari-bilocular, the loculi often approaching, or also found bilocular, the septum after KHO widening and the spore then becoming polari-locular with approximate loculi.

Quite frequent on various rocks at lower elevations, though ascending to 1,300 meters.

**3. *Blastenia luteominia* (Tuck.).**

*Placodium luteominium* Tuck. Syn. N. Amer. Lich. 1: 181. 1882.

Thallus granular, effuse and ill defined, KHO—,  $\text{Ca}(\text{ClO})_2$ —; apothecia sessile, grouped, 0.25 to 1 mm. wide; disk flat, orange to vermilion, the proper margin prominent, entire or very faintly striate, with KHO both disk and margin dark crimson; epithecium granulose, yellow to orange yellow; thecium 80  $\mu$  high; paraphyses free, the tips clavate and colored, septate; hypothecium colorless; spores oblong, some slightly curved, with 3 or 4 globules disappearing with KHO, the spores then polari-bilocular, the loculi approximate, without isthmus, 12 to 23  $\mu$  long, 3 to 5  $\mu$  thick.

On sandy clay, Point Loma near San Diego.

**4. *Blastenia subpyraceella* (Nyl.).**

*Lecanora subpyraceella* Nyl.; Hasse, Bull. Torrey Club 24: 446. 1897.

Thallus clay color, quite thin, obscure or absent; apothecia sessile, small, 0.25 to 0.75 mm. wide; disk pale yellow orange to rusty yellow, flat to planoconvex; proper margin yellow or pale orange, brighter than the disk, thin, persistent, quite entire; thecium 72 to 80  $\mu$  high; paraphyses not well separated, with globular heads, some furcate below the tips; asci oblong-tubular; hymenial gelatine dark blue with iodine; spores 8, oblong-ellipsoid, 12 to 20  $\mu$  long, 6 to 8  $\mu$  thick, polari-bilocular, the cells approximate and connected by a short isthmus.

On earth. Type locality, foothills of the Santa Monica Range near the Soldiers' Home; occurs also on crumbling sandstone.

Type deposited with Dr. W. Nylander in 1897; duplicates with Prof. Bruce Fink and Dr. A. Zahlbruckner, in the herbarium of the New York Botanical Garden, and in herb. Hasse.

**CALOPLACA T. Fries.**

Thallus crustaceous, uniform or lobed at the periphery, or dwarfed-fruticulose, mostly yellow; apothecia circular, appressed or sessile, lecanorine; asci 8-spored; spores colorless, ellipsoid, ovoid or, by bulging of the interocular space, rather rhomboidal, normally bilocular, exceptionally simple or trilocular, the loculi connected by a tube or isthmus; sterigma endobasidial, jointed; spermatia short, straight.

**KEY TO SPECIES.**

- Thallus fruticulose, dwarfish..... 13. *C. coralloides*.  
 Thallus not fruticulose.  
   Thallus crustaceous.  
     Effuse.  
       Yellow..... 5. *C. citrina*.  
       Not yellow.  
         White, thin..... 4. *C. gilva*.  
         White to grayish and obsolete..... 14. *C. pollinii*.



## Thallus not fruticulose—Continued.

## Thallus crustaceous—Continued.

Not effuse.

- Chinky or coarsely areolate, yellowish gray..... 1. *C. aurantiaca*.  
 Smooth and continuous, gray..... 3. *C. cerina*.

## Thallus squamulose.

Radiate at the periphery.

- Yellow..... 8. *C. cirrochroa*.

Orange.

- Radii linear, torulose..... 11. *C. elegans*.  
 Radii not torulose, flattened at periphery..... 10. *C. murorum*.

Not radiate at the periphery.

Squamules white to orange.

- White or pale yellow..... 7. *C. fulgens*.

Orange.

- Minute..... 6. *C. microphyllina*.  
 Not minute, convex, round or lobulate... 9. *C. bolacina*.

Squamules dark to blackish.

- Margin of disk white..... 2. *C. variabilis*.  
 Margin of disk dark..... 12. *C. pellodella*.

1. *Caloplaca aurantiaca* (Lightf.) T. Fries.

Thallus coarsely granular and verruculose-areolate, pale citrine yellow or grayish yellow, surrounded by a thin black hypothalline border or this indistinct, KHO+ dark crimson,  $\text{Ca}(\text{ClO})_2$ —; apothecia sessile, often crowded, 0.5 to 2 mm. wide; disk concave to flat, orange, the citrine yellow thalline margin prominent and persistent, entire to finally crenulate and, at times, at last sinuate; epithecium subgranulose, orange yellow, with KHO purple, as also the heads of the paraphyses; thecium colorless, with iodine deep blue; paraphyses coherent, yellow-capitate; hypothecium milky white; asci clavate; spores 8, ellipsoid, 10 to 15  $\mu$  long, 4.5 to 8  $\mu$  thick, polari-bilocular with a long isthmus.

On various barks, living or dead, and on rocks. Frequent throughout San Clemente Island, *Trask*; cortex of dead *Opuntia*, Newport; on Santa Catalina Island. Cosmopolitan.

2. *Caloplaca variabilis* (Pers.) T. Fries.

Thallus determinate, dark ash color, blackening, rimose-verruculose in the center, squamose at the periphery, the squamules crenulate, KHO+ violet; apothecia adnate, 0.25 or 1 mm. wide; disk flat, color of thallus, the thalline margin entire or finely crenulate, thin, whitish or light gray; epithecium gray, with KHO+ violet; thecium colorless, with iodine blue; paraphyses loosely coherent; the tips with one or two enlargements and a globular head, the latter colored in some paraphyses, septate below the heads, some furcate; hypothecium pale grayish; asci inflated-clavate, 60 to 72  $\mu$  long, 20 to 24  $\mu$  thick; spores 8, blunt-ellipsoid, 15 to 22  $\mu$  long, 5 to 9  $\mu$  thick, polari-bilocular, the loculi approximate, with or without an isthmus; upper third of asci dark, the lower part light blue with iodine, later with the spores turning yellowish.

On sandstone in the Santa Monica Range; on the same substratum near Marietta, Riverside County. Has not been collected at higher elevations.

3. *Caloplaca cerina* (Ehrh.) Zahlbr. in Engl. & Prantl, Nat. Pflanzenfam. 1<sup>1\*</sup>: 228. 1907.

*Lichen cerinus* Ehrh. Pl. Crypt. Dec. no. 216. 1785.

Thallus thin, effuse, whitish ash-colored, smoothish, or else absent, with KHO tardily pale red; apothecia sessile, small, not over 0.5 mm. wide, crowded in groups; disk flat, light orange, the thalline margin yellowish white, thin, persistent, with KHO



the disk staining bright crimson, the thalline margin also but more slowly; epithecium subgranulose, yellow; thecium colorless, with iodine deep blue, the yellow epithecium purple; hypothecium colorless; paraphyses loosely coherent, with globular heads, jointed and some furcate above; hypothecium colorless; asci clavate; spores 8, ellipsoid, 13 to 16  $\mu$  long, 7 to 8  $\mu$  thick, polari-bilocular, the isthmus very faint, in some spores invisible.

Frequent on various barks, less often on stone.

4. *Caloplaca gilva* (Hoffm.) Zahlbr. in Engl. & Prantl, Nat. Pflanzenfam. 1<sup>1\*</sup>: 228. 1907.

*Verrucaria gilva* Hoffm. Deutschl. Fl. 2: 98. 1795.

Thallus indeterminate, ash gray, granular to verrucose, KHO+ crimson; apothecia adnate-sessile, small, 0.2 to 0.5 mm. wide; disk flat, orange; thalline margin thin, entire, persistent, yellow to light orange, with KHO like the disk; epithecium a thin yellow line, subgranulose; thecium colorless; paraphyses loosely coherent, the heads globular; hypothecium colorless; apothecia clavate; spores 8, ellipsoid, 13 to 16  $\mu$  long, 5 to 6  $\mu$  thick; hymenial gelatine, except heads of paraphyses remaining unchanged, staining blue with iodine.

Frequent on barks. Santa Cruz Peninsula, Herre. Cosmopolitan.

5. *Caloplaca citrina* (Hoffm.) T. Fries.

Thallus sordid yellowish, granulose, effuse, forming a coarsely rimose crust, KHO+ purplish; apothecia adnate-sessile, small, crowded; disk soon convex, yellowish to orange; thalline margin thin, crenulate, later almost obsolete; epithecium subgranulose, rich yellow; thecium colorless, with iodine violet blue; paraphyses coherent, jointed, not branched, their heads globular; asci inflated-clavate; spores 8, ellipsoid, polari-locular, no isthmus seen, 14 to 18  $\mu$  long, 7 to 8  $\mu$  thick.

On argillaceous boulders, Santa Monica Range.

6. *Caloplaca microphyllina* (Tuck.).

*Placodium microphyllum* Tuck. Syn. N. Amer. Lich. 1: 174. 1882.

Has been reported from Southern California, but authentic specimens are not available for description.

7. *Caloplaca fulgens* (Swartz) Zahlbr. in Engl. & Prantl, Nat. Pflanzenfam. 1<sup>1\*</sup>: 228. 1907.

*Lichen fulgens* Swartz, Nov. Act. Soc. Sci. Upsal. 4: 246. 1794.

Thallus pale yellowish, mealy, forming small monophyllous or submonophyllous patches, from 1 to 2 cm. wide, closely adherent to substratum, rugulose in the center, imbricate-lobate at the periphery, the border of the lobes at times yellowish-suffused, KHO+ purplish; apothecia sessile, single or two in a patch; disk flat to convex, rusty red to rusty orange; thalline margin crenately interrupted, finally obsolete; epithecium subgranulose, deep or dark yellow; thecium colorless, 60 to 80  $\mu$  high, this and the epithecium with iodine deep blue; paraphyses adglutinated, some barely clavate at the tips; hypothecium yellowish or milky; asci clavate; spores narrowly ellipsoid, 9 to 13  $\mu$  long, 3 to 4.5  $\mu$  thick, straight or lightly curved, simple or faintly bilocular.

On earth near Palm Springs at 140 meters above sea level. Western and northern North America; Europe; Africa (Algiers); New Zealand.

8. *Caloplaca cirrochroa* (Ach.) T. Fries.

Thallus suborbicular, thin, adnate, citrine yellow, the radiating lobes of the circumference not contiguous, short, not well developed, the larger part of the thallus, the central, an areolate, sorediate crust, KHO+ purple; apothecia not seen.

Occasional in the Santa Monica Range, on sandstone.

9. *Caloplaca bolacina* (Tuck.) Herre, Proc. Washington Acad. Sci. 12: 233. 1910.

*Placodium bolacinum* Tuck. Lich. Calif. 18. 1866.



Crust composed of turgid, scattered or contiguous, round squamules, angular and difform from juxtaposition, KHO+ dark crimson; apothecia sessile, 0.5 to .5 mm. wide; disk of the color of the thallus or orange, concave to finally lightly convex, undulate and at times umbilicately depressed in the center, KHO+ deep orange; proper margin paler than the disk; thalline margin obscure but perceptible under the rim of the apothecium; epithecium subcontinuous, yellowish orange; thecium colorless, 76 to 80  $\mu$  high, with iodine blue, but the epithecium not changed; paraphyses loosely coherent, clavate with round, yellow orange heads; hypothecium colorless, milky; asci clavate and subinflated-clavate; spores 8, oblong, bluntly ellipsoid, 13 to 16  $\mu$  long, 5 to 6  $\mu$  thick, polari-bilocular with an isthmus; hymenial gelatine with KHO crimson; spermatia 2 to 4  $\mu$  long, less than 1  $\mu$  thick.

On sandstone and clay. Common on plains and in the foothills.

**10. Caloplaca murorum** (Hoffm.) T. Fries.

Crust from vitelline yellow to orange, orbicular, closely appressed, rimose-verruculose in the center, toward the circumference radiately lobed, the radii contiguous, the peripheral border crenate-lobed, flattening, dilated and paler in color; upper surface of thallus with KHO purple, the lower surface not stained; apothecia crowded in central part, sessile, 0.25 to 1 mm. wide; disk concolorous with the thallus, flat; thalline margin thin, entire, persistent; epithecium granulose, orange yellow; thecium colorless, 80  $\mu$  high; paraphyses laxly coherent, the globose, yellow tips with several jointed enlargements beneath, some paraphyses furcate under the tips; asci clavate, the membrane thickened at the top; spores 8, ellipsoid, 11 to 13  $\mu$  long, 4 to 7  $\mu$  thick, polari-bilocular; hymenial gelatine blue with iodine.

Frequent. On various rocks, from the foothills ascending the mountains to about 1,500 meters; Santa Catalina Island. Widespread from the northern United States to arctic America; Africa and Europe.

With us the forma *miniata* (Hoffm.) T. Fries of authors, with dark orange thallus prevails, the typical plant, with vitelline yellow thallus being rare.

**11. Caloplaca elegans** (Link) T. Fries.

Thallus orbicular, the color a dark orange approaching vermilion, loosely appressed to rugulose-turgid, the discrete radiating laciniae lobate-crenate at the periphery, the center confusedly verrucose, KHO+ purple; apothecia sessile, the size of those of *C. murorum*; disk from flat to planoconvex, concolorous with the thallus; thalline margin thin, entire, at last almost disappearing, KHO+ purple; epithecium subcontinuous, rich yellow; thecium 64 to 68  $\mu$  high, colorless, in places yellow streaked from the epithecium; paraphyses strict, coherent, clavate above, septate and surmounted by a faint yellowish head; hypothecium faint yellowish; asci inflated-clavate; spores 8, ellipsoid, 12 to 14  $\mu$  long, 5 to 7  $\mu$  thick, polari-bilocular, the isthmus faint or absent; thecium and epithecium deep violet blue with iodine; spermatia straight, less than 1  $\mu$  thick.

Crystalline rocks in the mountains above 1,500 meters, here taking the place of the preceding plant.

San Bernardino Mountains, *Parish*; in the San Gabriel and San Jacinto Ranges. Northern United States to the arctic regions; northern Asia; Abyssinia; Europe; New Zealand.

The color of the form *miniata* of *C. murorum* is so similar to that of the present species that a first glance may be deceiving.

**12. Caloplaca pellodella** (Nyl.).

*Lecanora pellodella* Nyl. Act. Soc. Sci. Fenn. **26**: 29. 1899.

Thallus dark olive green, squamulose, forming small, irregularly orbiculate patches; disk of apothecia concolorous with the thallus; spores 8, 10 to 11  $\mu$  long, 5 to 6  $\mu$  thick, polari-bilocular; epithecium purplish with KHO.



On granite boulders near Elsinore, the type locality. Type deposited with Dr. W. Nylander in 1898; duplicates in herbarium of New York Botanical Garden and the U. S. National Herbarium.

The brief and insufficient description given is taken from Doctor Nylander's notes, the only source available to the author, who has no type specimen left and has not collected it since the year of its discovery, 1898.

**13. *Caloplaca coralloides*** (Tuck.) Zahlbr. Ann. Naturh. Hofmus. Wien **22**: 116. 1907.

*Placodium coralloides* Tuck. Proc. Amer. Acad. **6**: 287. 1864.

Thallus dwarfed, fruticulose, orange yellow or vitelline, terete-torulose, forking, decumbent to erect, 2 to 3 mm. high, KHO+ dark purple, as also the disk; apothecia pedicellate, the terminal sometimes clustered; disk flat, orange, the thalline margin entire, persistent; epithecium subcontinuous, grayish yellow; thecium colorless, 76 to 80  $\mu$  high; paraphyses loosely coherent, clavate and globular above, the heads of the same color with the epithecium, beneath the heads one or two joints; asci clavate, 66 to 72  $\mu$  long, 12  $\mu$  thick, the membrane thin throughout; spores 8, oblong-ellipsoid, 10 to 13  $\mu$  long, 3 to 4  $\mu$  thick, the loculi approximate without connecting tube (or isthmus); all hymenial structures blue with iodine and rose purple with KHO.

On sandstone cliffs at and above tidewater, Santa Catalina and San Clemente islands, *Trask*; at Newport and Del Mar on the mainland.

**14. *Caloplaca pollinii*** (Mass.) Jatta.

Thallus of minute, dispersed, gray granules to obsolete; apothecia small, adnate, not over 0.5 mm. wide, dull brown black, flat; epithecium granulose, pale brownish; thecium colorless; paraphyses loosely coherent, their tips globular, surmounting one or two enlargements; hypothecium colorless; asci clavate or oblong; spores 8, oblong-ellipsoid, colorless, polari-locular with a faint connecting tube, becoming plainer after KHO, 12 to 17  $\mu$  long, 5 to 7  $\mu$  thick; all structures staining blue with iodine.

On dead wood at Eden Hot Springs, Riverside County.

The mature apothecia are biatorine in aspect, but those of a junior state have a thin and inconspicuous yet distinguishable thalline margin.

## TELOSCHISTACEAE.

Thallus foliaceous or fruticulose; apothecia sessile, marginal or terminal; spores 8, colorless, polari-bilocular or quadrilocular; sterigma endobasidial, jointed; spermatia short, straight; gonidia Protococcus.

### KEY TO GENERA.

- Thallus foliaceous, horizontal-spreading or ascendent... XANTHORIA (p. 116).  
Thallus fruticulose, ascending to erect..... TELOSCHISTES (p. 117).

### XANTHORIA T. Fries.

The foliaceous thallus horizontally spreading or ascending, affixed to the substratum by rhizoids; apothecia circular, sessile or adnate, lecanorine; spores 8, polari-bilocular; sterigma endobasidial; spermatia short, oblong-ellipsoid.

### KEY TO SPECIES.

- Apothecia rare; thallus erect, the lobes short, finely lacerate  
above..... 1a. *X. lychnea pygmaea*.  
Apothecia more or less common.  
Apothecia numerous; thallus lobes laciniate..... 1c. *X. lychnea polycarpa*.  
Apothecia less numerous.  
Thallus lobes laciniate, suberect..... 1. *X. lychnea*.  
Thallus lobes laciniately dissected into linear divisions..... 1b. *X. lychnea laciniosa*.



1. *Xanthoria lychnea* (Ach.) T. Fries.

Thallus yellow to orange, ascending, the lobes compound, laciniately divided, crowded, effusely spreading or in orbicular patches,  $\text{KHO}+$  purple,  $\text{Ca}(\text{ClO})_2$ —; apothecia sessile, not frequent; disk concolorous with the thallus, concave, with an entire, permanent thalline margin somewhat paler than the thallus; epithecium subcontinuous, yellow; thecium colorless, 100 to 108  $\mu$  high; paraphyses stout, septate, some forked below the globular yellow apices; hypothecium colorless, overlying a thick gonidial layer; asci subinflated-clavate, the membrane thickened at the top; spores 8, oblong-ellipsoid, 12 to 20  $\mu$  long, 6 to 10  $\mu$  thick, polari-bilocular with a very faint connecting isthmus; hymenial gelatine with iodine blue, the thickened tops of the asci dark blue, the paraphyses not stained.

On various barks and dead wood; frequents lower altitudes. Throughout the United States; North and South America; Europe.

1a. *Xanthoria lychnea pygmaea* (Bory) Herre, Proc. Washington Acad. Sci. 12: 236. 1910.

*Borrera pygmaea* Bory; Fries, Lich. Eur. Ref. 73. 1831.

Thallus effusely spreading or pulvinate, orange color, the minute irregularly cleft lobes with finely lacerate or crenate border; apothecia rare.

A form of the Pacific coast; San Clemente Island on bleached bones, *Trask*; on sandstone near Newport, Orange County.

1b. *Xanthoria lychnea laciniosa* (Dufour) Herre, Proc. Washington Acad. Sci. 12: 235. 1910.

*Parmelia parietina laciniosa* Dufour; Fries, Lich. Eur. Ref. 73. 1831.

The pulvinate-orbicular, orange-colored thallus laciniately dissected into linear divisions, freely fruiting.

Frequent on barks in the Santa Monica Range. Throughout the United States; Europe.

1c. *Xanthoria lychnea polycarpa* (Ehrh.) T. Fries.

Thallus similar to that of the species, but not so well developed, orbicular-pulvinate, much and deeply cleft; apothecia numerous, often covering the thallus in the center.

Barks, fences, and dead wood, throughout our district. North America and Europe.

**TELOSCHISTES** Norm.

Thallus fruticulose, decumbent or erect, branching, terete or compressed-terete; apothecia sessile, lecanorine, marginal or lateral; spores 8, colorless, polari-bilocular (in our species); spermatia short, straight; sterigma endobasidial, jointed.

## KEY TO SPECIES.

Thallus erect, terete, smooth..... 2. *T. flavicans*.

Thallus not terete.

Minutely hispid, compressed, canaliculate..... 3. *T. villosus*.

Not hispid, compressed, flat..... 1. *T. chrysophthalmus*.

1. *Teloschistes chrysophthalmus* (L.) T. Fries.

Fruticulose, erect, compressed, linear-laciniate, greenish grayish to yellowish orange; apothecia subterminal and terminal; disk dark orange, thalline margin and the thallus fringed with fibrillæ; epithecium yellow, subgranulose; thecium colorless, 100  $\mu$  high; paraphyses strict, compacted, septate and slightly thickened at the tips; hypothecium colorless; asci clavate; spores 8, broadly ellipsoid, polari-bilocular with a connecting tube or isthmus, 13 to 17  $\mu$  long, 8 to 11  $\mu$  thick; epithecium with  $\text{KHO}+$  purple, but neither thallus nor disk stained by this reagent.

On shrubs or branches of trees. Throughout the United States; Lower California, *Orcutt*; Santa Catalina Island. Cosmopolitan.



**2. *Teloschistes flavicans* (Swartz) Norm.**

Fruticulose, erect, terete or slightly compressed, branching, often intricately so, thallus smooth or with the apothecia fringed with fibrils and beset with soredia, apothecia usually subterminal (freely fruiting with us), disk flat to lightly convex the thalline margin thin, crenulate or entire, at last obscure; epithecium yellow, subgranulose, thin but better defined than in *T. chrysophthalmus*; thecium colorless, 84 to 88  $\mu$  high; paraphyses coherent, septate; hypothecium colorless; asci clavate; spores 8, ellipsoid, polari-bilocular with a connecting tube, 10 to 20  $\mu$  long, 6 to 12  $\mu$  thick; thallus and disk with KHO purple,  $\text{Ca}(\text{ClO})_2$ —.

A conspicuous and handsome lichen on shrubs and branchlets frequent in our district. Widely distributed through the warmer regions.

**3. *Teloschistes villosus* (Ach.) Norm.**

Thallus fruticulose, erect or suberect, pale gray, compressed-canaliculate, minutely hispid with short white bristly hairs on the dorsal surface, the attenuate-laciniate, linear ultimate ramifications subterete; apothecia few, subterminal; disk concave, yellowish red, the thalline margin thin, obscure; epithecium finely granulose, yellow; thecium colorless 56  $\mu$  high; paraphyses free, branched, septate, capitate at the slightly colored tips; hypothecium colorless; asci clavate; spores 8, oblong-ellipsoid, 11 to 14  $\mu$  long, 4.5 to 6  $\mu$  thick; hymenial gelatine with iodine blue, the asci darkest at the top, KHO staining the epithecium and heads of the paraphyses a carmine red, the disk also, but the thallus not affected.

On living and dead shrubs, Lower California, *Orcutt*; Point Loma near San Diego, on *Lycium californicum*; near Newport, Orange County, and as far north as Santa Cruz Island, off Santa Barbara, where it was collected by Mrs. Blanche Trask.

**BUELLIACEAE.**

The crustaceous thallus varying from uniform to squamulose, often becoming radiately lobed at the periphery; apothecia round, embedded in or sessile upon the thallus; spores mostly 8, colored, bilocular to quadrilocular or submuriform; sterigma jointed; spermatia short, straight.

**KEY TO GENERA.**

- |                           |                    |
|---------------------------|--------------------|
| Apothecia lecideine.....  | BUELLIA (p. 118).  |
| Apothecia lecanorine..... | RINODINA (p. 123). |

**BUELLIA** De Not.

Thallus uniform to squamulose, a radiating lobation less pronounced than in the following genus; gonidia *Protococcus*; apothecia round, immersed, adnate or sessile; disk dark, blackish, with a dark, often horny hypothecium; spores as stated.

**KEY TO SPECIES.**

Thallus more or less lobed at periphery.

Substratum earth; thallus pale ash color..... 4. *B. bolacina*.

Substratum rock (*B. alboatra* occasionally on bark).

Thallus well developed.

Light colored.

Yellowish..... 3. *B. lepidastr*.

White, mealy..... 1. *B. rinodinoides*.

Dark olive green to brown.

Lobed at periphery..... 6. *B. badia*.

Not lobed at periphery..... 5. *B. pullata*.

Thallus not well developed, whitish, the loba-

tion indistinct..... 2. *B. alboatra*.



**Thallus not lobed at periphery.****Substratum rock.**Thallus granular, gray (occurring also on bark).... 9. *B. myriocarpa*.**Thallus not granular.**Squamulose, white; squamules dispersed..... 7. *B. retrovertens*.**Not squamulose.**Rimose-areolate, white..... 8. *B. stellulata*.Effuse, whitish..... 2a. *B. alboatra ambigua*.**Substratum bark.****Thallus white.**Spores bilocular..... 13. *B. penichra*.Spores quadrilocular..... 11. *B. triphragmia*.**Thallus not white.****Gray to greenish gray.**Coarsely granular to warty..... 10. *B. parasema*.Less coarse, granular, smoother..... 10a. *B. parasema vulgata*.**Thallus yellow to greenish yellow.**On rock, rimose-areolate..... 14. *B. halonia*.On bark, squamulose..... 12. *B. oidalea*.**1. Buellia rinodinoides Anzi.**

Thallus white, farinaceous, coarsely and distinctly rimose-areolate; areolae flat to turgid, round-angular and sinuous, with KHO tardily sordid orange,  $\text{Ca}(\text{ClO})_2$ —; apothecia black, naked, innate and flat to adnate and convex, the proper margin thin, concolorate and finally disappearing; epithecium subgranulose, fuliginous blackish; thecium colorless, 88 to 90  $\mu$  high, with iodine blue; paraphyses loosely coherent, simple, not jointed, the fuliginous tips clavate; hypothecium fuscous; asci clavate; spores blunt-ellipsoid, brownish gray, bilocular, 9 to 16  $\mu$  long, 5 to 8  $\mu$  thick, not or barely constricted at the middle; episporium thin.

On disintegrated granite, Palm Springs, Riverside County; calcareous rocks on the beach at "White Point" near San Pedro. Found also in Japan and Europe.

**2. Buellia alboatra (Hoffm.) T. Fries.**

Thallus effuse or peripheral lobation indistinct, whitish, areolate-rimose and areolate-verrucose, KHO—,  $\text{Ca}(\text{ClO})_2$ —, farinaceous, poorly developed, mostly in small patches; apothecia sessile, generally several grouped; disk black or with a faint bloom, soon slightly convex, the thin, black proper margin persistent, entire; thecium colorless; paraphyses separate, jointed, somewhat gelatinous, with dark heads; asci clavate; hypothecium pale brown; spores 8, oblong-ellipsoid, 16 to 20  $\mu$  long, 7 to 10  $\mu$  thick, 4-locular, often a little curved, the episporium stout; hymenial gelatine blue with iodine; spermatia cylindric, straight.

On bark and rocks; bark of *Pseudotsuga* in the Tehachapi Mountains at 1,300 meters altitude; on rocks in the Santa Monica Range.

This is variety *saxicola* Fries of authors.

**2a. Buellia alboatra ambigua (Ach.) T. Fries.**

Thallus rimose-areolate, effigurate, thin with a blackish hypothalline border (at times absent); apothecia adnate; disk flat, often with a faint bloom and having a permanent, entire or crenulate, thickened thalline margin.

Frequent on slate schist in the Santa Monica Range.

Distinguished from the species by the thinner, effigurate thallus.

**3. Buellia lepidastrum Tuck.**

Thallus squamulose-areolate, pale yellowish or sordid buff, the flat, soon convex, coarse squamules becoming lobate at the circumference, KHO+ yellow,  $\text{Ca}(\text{ClO})_2$ —; hypothallus black; apothecia sessile, 0.25 to 1 mm. wide; disk convex with a thin,



entire margin, this finally disappearing; epithecium subcontinuous, dark brown; thecium  $64\ \mu$  high, sordid, with iodine blue; paraphyses loosely coherent, coarse, jointed, their heads black brown, globular; hypothecium dark brown; asci clavate and subinflated-clavate; spores 8, ovoid-ellipsoid, bilocular, brown,  $12$  to  $18\ \mu$  long,  $5$  to  $10\ \mu$  thick, slightly constricted; spermogones shown as small black depressions; spermatia rod-like, straight,  $8$  to  $12\ \mu$  long and somewhat over  $1\ \mu$  thick, with acuminate ends.

On siliceous and calcareous rocks in the Santa Monica Range; near Elsinore and elsewhere in southern California. Found also in the northern, southern, and eastern United States.

#### 4. *Buellia bolacina* Tuck.

"Thallus of scattered, turgid, wavy and plicate, glebous squamules ( $1$  to  $2$  mm. wide), from greenish glaucescent at length white; apothecia small (scarcely reaching  $1$  mm. in width), adnate, planoconvex, opaque, subimmarginate, the margin soon disappearing, the hypothecium blackening; spores ellipsoid, bilocular,  $12$  to  $20\ \mu$  long by  $6$  to  $10\ \mu$  thick. The well-developed paraphyses loose and brown-headed."

On the earth in mesas, San Diego, *Cooper*; in the same habitat, Lower California, *Orcutt*.

Authentic specimens not having been seen, the above description is copied from Tuckerman.

#### 5. *Buellia pullata* Tuck.

Thallus rimose-areolate or of dispersed "dark olivaceous brown" and blackening, flat squamules; apothecia adnate, small, not over  $0.5$  mm. wide; disk black, flat with a concolorous, thin, rather indistinct proper margin; epithecium subcontinuous, brown black; thecium  $80$  to  $88\ \mu$  high, colorless, stained handsome blue with iodine, but neither epithecium nor hypothecium affected by this reagent; paraphyses coherent, about  $3\ \mu$  thick, jointed, some thickened above and with brown black heads; hypothecium brown black like the epithecium; asci clavate and subinflated-clavate,  $48\ \mu$  long,  $16$  to  $18\ \mu$  thick; spores 8, ellipsoid, brown, bilocular,  $12$  to  $16\ \mu$  long,  $7$  to  $11\ \mu$  thick, little or not at all constricted, the loculi with a bluish gray center.

On trap rock, Topanga Canyon, Santa Monica Range, at  $230$  meters altitude. Reported also from the vicinity of San Francisco by Dr. A. C. Herre.

#### 6. *Buellia badia* (Fries) Koerb.

Thallus dark olivaceous brown, rimose and squamulose, the squamules flat, rugulose, lobate-crenate; apothecia innate and adnate-sessile, from  $0.5$  to  $1$  mm. wide, often two or several grouped; disk black, flat to convex, the proper margin thin, entire, black, finally almost disappearing; epithecium brown, granulose; thecium  $60\ \mu$  high, light brown; paraphyses separate, slender, with brown, abruptly capitate tips; hypothecium light to dark brown; asci inflated-clavate; spores  $12$  to  $14\ \mu$  long,  $7$  to  $8\ \mu$  thick, obtuse-ellipsoid, bilocular, constricted; hymenial gelatine with iodine blue.

On sandstone and crystalline rocks. Foothills of the San Gabriel Mountains near Sierra Madre, Los Angeles County; running over mosses on boulders in the Yosemite Valley. Reported from Kansas, but principally west of the Rocky Mountains from Washington southward.

#### 7. *Buellia retrovertens* Tuck.

Thallus whitish, convex, round or sublobulate areoles, scattered or loosely aggregated, KHO+ greenish yellow, Ca(ClO)<sub>2</sub>—; apothecia adnate-sessile,  $0.25$  to  $1$  mm. wide; disk black, at first flat with a thin erect margin, later convex and immarginate; epithecium brown black, subgranulose; thecium colorless, partly light brownish,  $60\ \mu$  high, with iodine blue then sordid blue; paraphyses coherent, not distinct, with brownish capitate tips; hypothecium pale brown; asci clavate, rounded at top,  $45$



to 50  $\mu$  long, 12  $\mu$  thick; spores smoky gray to brown, 11 to 16  $\mu$  long, 7 to 8  $\mu$  thick, ellipsoid, the septum and epispore thick, not constricted, slightly paler at center of each locus.

On trap rock, Topanga Canyon, Santa Monica Range; at Del Mar on quartz; head of Bright Angel Trail, Grand Canyon, Arizona. From the Rocky Mountain Region westward.

**8. *Buellia stellulata* (Taylor) Mudd.**

Thallus whitish, thin, forming a finely rimose-areolate crust, the areoles flat or lightly convex, with a black encircling hypothallus; apothecia very small, scarcely 0.5 mm. in width; disk black, flat with a black proper margin, becoming immarginate; epithecium subcontinuous, brown; paraphyses loose, septate, brown capitate; hypothecium lighter brown than the epithecium; asci clavate; thecium blue with iodine, about 72  $\mu$  high; spores ellipsoid, both ends obtuse, bilocular, slightly constricted, 10 to 12  $\mu$  long, 4 to 5  $\mu$  thick, smoky gray to brown; medulla not stained by iodine.

On rocks: San Diego, *Orcutt*; Santa Monica Range and northward. Distributed through the eastern United States; cosmopolitan.

**9. *Buellia myriocarpa* (Lam. & DC.) Mudd.**

Thallus whitish, gray to grayish green, thin, indeterminate, pulverulent, or obsolete; apothecia small, about 0.25 mm. wide; disk flat, becoming convex, black, the proper margin concolorous, thin, soon obsolete; epithecium brownish black; thecium colorless, 44 to 48  $\mu$  high; paraphyses strict with brown, capitate tips; hypothecium brown black; asci clavate; spores 8, oblong-ellipsoid, smoky gray to brown, not constricted, bilocular, 12 to 16  $\mu$  long, 4 to 8  $\mu$  thick; sterigma branched, articulate, spermatia staff-shaped and narrow-fusiform, tapering at each end, 4 to 8  $\mu$  long, slightly exceeding 1  $\mu$  in thickness.

Common on barks, wood, and stones. It varies somewhat as to thallus and size of apothecia, hence several forms are described of which we have: *Forma punctiformis* (Hoffm.) Mudd, with the thallus indistinct, light gray, the apothecia minute—on siliceous pebbles and conglomerate, Cahuenga Pass, Santa Monica Range; *forma chloropolia* (Fries) T. Fries, with the thallus granulose, dark gray when dry, greenish when moistened, the apothecia very minute—on bark of *Cercocarpus betulaeifolius*, Santa Monica Range; and *forma ecrustacea* Leight., the thallus absent, the apothecia small—on trap rock, Topanga Canyon, Santa Monica Range.

**10. *Buellia parasema* (Ach.) Koerb.**

Thallus light gray or with a faint yellowish tint, minutely squamulose, "chinky," surrounded by a thin, black hypothalline border, KHO+ citrine yellow, then gradually greenish; apothecia sessile, from 0.25 to 1 mm. wide; disk black, flat to convex, the thin, black proper margin finally disappearing; epithecium subgranulose, brown, thin; thecium 56 to 76  $\mu$  high, colorless or in places light brownish rays extending upward from the hypothecium; paraphyses clavate with a brownish capitate top and jointed above; hypothecium dark brown, thick; asci inflated-clavate; spores 8, ellipsoid-oblong, brown, bilocular, 16 to 20  $\mu$  long, 6 to 8.5  $\mu$  thick, with a smoky grayish spot in each locus, but in fully matured spores the loculi uniform brown, the spores slightly or not constricted, straight or somewhat obliquely curved; spermatia straight, narrowly fusiform, 4 to 8  $\mu$  long, about 1  $\mu$  thick.

On various smooth barks and dead wood. A common, cosmopolitan species and quite variable, but of the forms of authors only the following variety has been found with us:

**10a. *Buellia parasema vulgata* T. Fries.**

Described as having a smoother thallus, the black hypothalline border indistinct or wanting; apothecia small, punctiform, barely 0.5 mm. wide, epithecium sub-



granulose, brown, the color mostly due to the colored heads of the paraphyses; thecium 64 to 68  $\mu$  high, colorless; paraphyses laxly coherent; hypothecium fuscous; asc-clavate or subinflated-clavate; spores 8, 12 to 17  $\mu$  long, 5 to 5.5  $\mu$  thick.

On smooth bark of *Quercus agrifolia* in the Santa Monica Range.

**11. Buellia triphragmia** (Nyl.).

*Lecidea triphragmia* Nyl. Mém. Soc. Sci. Nat. Cherbourg 5: 126. 1857.

Epithecium subcontinuous, dark brown, gradually paling downward; thecium pale yellowish brownish, 84 to 88  $\mu$  high; paraphyses coherent, slightly clavate at the brown tips; hypothecium dark blackish brown; asci inflated-clavate; spores 8, oblong-ellipsoid, 19 to 24  $\mu$  long, 8 to 11  $\mu$  thick, 4-locular, the immature, colorless spores seen to be bilocular, otherwise but few bilocular ones present.

On bark of *Pseudotsuga macrocarpa* and dead wood in the San Gabriel Range; Mount Wilson, at 1,550 meters altitude.

**12. Buellia oidalea** Tuck.

Thallus pale yellow with a greenish tinge, verruculose-rimose, glaucescent, KHO+ greenish yellow, Ca(ClO)<sub>2</sub>—, limited by a black hypothallus; apothecia minute, 0.2 to 1.75 mm. wide, immersed, later sessile; disk black, soon convex, the at first entire proper margin crenulate; epithecium continuous, brown, paling downward; thecium colorless, 140  $\mu$  high, with iodine blue; paraphyses loosely coherent, the tips slightly capitate, some forked below the tips, not colored; hypothecium brown like the epithecium, 100 to 108  $\mu$  high; asci inflated-clavate, the membrane thickened at upper part (20  $\mu$  thick); spores ellipsoid and oblong-ellipsoid, varying from 1 to 6 in a spore sack, 28 to 68  $\mu$  long, 16 to 24  $\mu$  thick, muriform, with 7 septa in the transverse diameter and several in the longitudinal axis, the spores varying from colorless to gray and finally brown.

On various barks. On bark of the Torrey pine, San Nicolas Island, *Trask*; bark of shrubs, Santa Catalina Island, *Trask, Baker*; on *Adenostoma fasciculatum* at Point Loma, near San Diego.

**13. Buellia penichra** (Tuck.).

*Buellia oidalea penichra* Tuck. Syn. N. Amer. Lich. 2: 99. 1888.

Thallus white, smooth or slightly rugulose, becoming chinky, KHO—, Ca(ClO)<sub>2</sub>—, occurring in small patches limited by a black hypothalline border; apothecia sessile, 0.25 to 1 mm. wide; disk dull black, flat, with a turgid, black, entire, somewhat glistening proper margin, later subimmarginate; epithecium subgranulose, brown; thecium colorless, 100  $\mu$  high; paraphyses loosely coherent; hypothecium yellowish brown, a little paler than the epithecium; asci inflated-clavate, nearly as high as the thecium; spores 6 to 8, bluntly ellipsoid, 14 to 28  $\mu$  long, 7 to 14  $\mu$  thick, submuriform, with 4 or 5 transverse septa and several in the longitudinal axis.

On bark of *Pseudotsuga macrocarpa*, Mount Wilson, Los Angeles County, at 1,500 meters altitude.

**14. Buellia halonia** (Ach.) Tuck.

Thallus uniform, greenish yellow, rimose-areolate, the areoles smooth, flat, angular, encircled by a black hypothalline border, KHO+ pale yellow, Ca(ClO)<sub>2</sub>+ orange; apothecia black, opaque, sessile; disk flat, at last convex, the margin permanent, concolorous, entire or crenulate-angulose; epithecium subgranulose, brown; thecium colorless, 72  $\mu$  high; paraphyses loosely coherent, simple, some brown-capitate above; hypothecium rather more than half the height of the thecium and a little paler than the epithecium, gradually paling upward, horny; asci inflated-clavate, 70  $\mu$  long, 16  $\mu$  thick; spores ellipsoid, both ends blunt, bilocular, brown when mature, 13 to 16  $\mu$  long, 6 to 8  $\mu$  thick; hymenial gelatine with iodine intense blue; spermatogones not seen.

On calcareous rocks, Santa Catalina Island.



**RINODINA** (Ach.) S. F. Gray.

Thallus uniform or effigurate and lobed at the periphery, destitute of rhizinæ; apothecia lecanorine, the disk dark; spores commonly bilocular, rarely 4-locular; sterigma short, straight.

## KEY TO SPECIES.

Substratum mineral.

Substratum rock.

Thallus not lobed at periphery, light gray..... 7. *R. confragosa*.

Thallus lobed at periphery.

Densely pruinose throughout..... 1b. *R. radiata lactea*.

Not densely pruinose.

Red brown to brown..... 4. *R. thysanota*.

Lighter colored.

Yellowish..... 2. *R. oreina*.

Not yellowish.

Whitish to gray.

Conspicuously radiate-lobed at the periphery..... 1. *R. radiata*.

Depauperate; radiate lobation

lost..... 1a. *R. radiata fimbriata*.

Sordid buff..... 3. *R. angelica*.

Substratum earth; thallus not lobed at periphery, uniform, dark.

Spores 2-locular..... 5. *R. turfacea*.

Spores becoming 4-locular..... 6. *R. conradi*.

Substratum vegetable, bark or wood.

Thallus brown, rimose..... 11. *R. hallii*.

Thallus of some shade of gray.

Dull greenish gray..... 10. *R. succedens*.

Of an ordinary gray.

Thallus staining yellow with iodine..... 12. *R. roboris*.

Not staining yellow.

Thallus effusely granular-areolate..... 8. *R. sophodes*.

Reduced, almost obsolete (occurring also on rock)..... 9. *R. exigua*.

**1. Rinodina radiata** Tuck.

Thallus whitish gray to gray, closely appressed, orbicular, in the center rimose-areolate, the periphery radiate-lobed, the radii flattening, somewhat dilated and lobulate at the border, KHO—, Ca(ClO)<sub>2</sub>—, the medulla with iodine—, a more or less distinct, black hypothallus encircling the thallus; apothecia crowded in the center, innate then adnate, scarcely exceeding 0.8 mm. in width; disk flat then convex, often subpruinose, the thalline margin persistent, entire; epithecium subgranulose, yellowish grayish; thecium colorless, 84 to 88  $\mu$  high, sometimes brownish tinged; paraphyses coherent, with brown tips, septate; hypothecium brown; asci clavate, the membrane thickened at top; spores ovoid-ellipsoid, constricted, brown, bilocular, 10 to 13  $\mu$  long, 6 to 7  $\mu$  thick; spermogones designated by minute, black, funnelform depressions, their contents staining yellow with iodine; sterigma simple, straight, inverted club-shaped; spermatia short, straight, 8 to 12  $\mu$  long, less than 1  $\mu$  thick; thecium with the epithecium and hypothecium deep blue with iodine.

On various rocks throughout the district; a Pacific Coast lichen.



**1a. *Rinodina radiata fimbriata* Tuck.**

"Thallus depauperate," without the peripheral radiation, the limiting black hypothallus distinct.

With the species but less frequent.

**1b. *Rinodina radiata lactea* subsp. nov.**

Thallus appressed, white, orbicular, pulverulent, rimose-areolate in the center, radiate-lobate at the periphery, the radiating lobes contiguous, flattened and slightly dilated outward, with an entire or subcrenulate border; hypothallus black, not distinct, KHO—, Ca(ClO)<sub>2</sub>—, the medulla with iodine—; apothecia innate to adnate, crowded in the center, 0.25 to 1.25 mm. wide; disk flat to at last convex, dull black, permanently densely white pruinose; thalline margin permanent, mostly thin; epithecium granulose, pale dingy yellowish; thecium colorless, 60  $\mu$  high, deep blue with iodine, including the epithecium; paraphyses coherent, strict, scarcely clavate at the tips, indistinctly septate; hypothecium brown, darker than the epithecium; asci clavate, the membrane thickened above; spores 8, 9 to 15  $\mu$  long, 4 to 8  $\mu$  thick, blunt-ellipsoid, bilocular, brown, constricted, the epispore thin; sterigma narrowly inverted-clavate, very indistinctly jointed; spermatia short, straight, 6 to 8  $\mu$  long, 1 to 1.5  $\mu$  thick; spermogones indicated by minute black dots.

On calcareous and argillaceous rocks in the vicinity of the ocean. The type is from Santa Catalina Island, but the same is found also at Newport along the beach bluffs.

Type deposited with Dr. A. C. Herre; duplicate in herb. Hasse.

**2. *Rinodina oreina* (Ach.) Mass.**

Crustaceous, pale sulphur color, closely appressed, the center rimose-areolate, becoming radiately lobed at the periphery, often blackish-suffused, giving the whole plant a dark appearance; apothecia innate, emerging to adnate, 0.5 to 1 mm. wide; disk black, at last slightly convex; thalline margin entire; paraphyses coherent; asci clavate; spores 8, round-ellipsoid, bilocular, brown, 9 to 12  $\mu$  long, 5 to 8  $\mu$  thick, little or not at all constricted, the epispore thin.

Not infrequent in the mountains above 1,500 meters. On quartzose rocks in the San Gabriel, San Bernardino, and San Jacinto Ranges. Occurs in the northern and western United States and in Europe.

**3. *Rinodina angelica* Stizenb.; Hasse, Bull. Torrey Club 24: 447. 1897.**

Thallus crustaceous, rimose-areolate, or squamous, becoming lobate at the circumference, the squamules contiguous, light grayish flesh color, the fertile ones subverrucose, prominent, KHO + greenish yellow soon crimson, Ca(ClO)<sub>2</sub>—; apothecia innate to adnate; disk flat, occasionally emerging to planoconvex, 0.25 to 1 mm. wide, dull black or with a faint bloom; thalline margin persistent, in well-developed specimens turgid, entire or crenulate; epithecium granulose, yellowish brown; thecium 120 to 128  $\mu$  high; paraphyses subcoherent, with round, colored heads or but slightly clavate and not colored above, indistinctly jointed, not forked; hypothecium colorless or nearly so; asci inflated-clavate to ventricose, the membrane thickened at top; spores 8, brown, bilocular, 16 to 26  $\mu$  long, 8 to 12  $\mu$  thick, the spots of the loculi obcordate with an isthmus; epithecium and hypothecium with KHO + orange and the thecium yellowish orange; spermatia 4 to 6  $\mu$  long and less than 1  $\mu$  thick, straight.

On rocks. Type locality, foothills of the Santa Monica Range near the Soldiers' Home. It is frequent in the Santa Monica Range and southward, but has not been found above about 1,500 meters; Santa Catalina Island.

Type deposited in the Herbarium of the New York Botanical Garden; duplicates in the U. S. National Herbarium, with Dr. A. C. Herre, and in herb. Hasse.

**4. *Rinodina thysanota* Tuck.**

Thallus crustaceous, closely affixed, forming round patches 5 mm. wide and by aggregation increasing to several centimeters, in color sienna brown or somewhat



lighter, irregularly rimose in the center and radiate at the periphery, the linear, narrow, contiguous radii forked or crenate and slightly dilated at the extremities, occasionally the peripheral ends whitish pruinose; apothecia rarely seen, small, not over 0.25 mm. wide, the disk plane, brown black with a thin, persistent thalline margin; epithecium subgranulose, brown; thecium  $88\ \mu$  high; paraphyses loose, thick, with 2 or 3 septa, the internodes a little enlarged, the apices grayish brown; hypothecium of the color of the thallus; asci 48 to  $52\ \mu$  long, 20 to  $24\ \mu$  thick, the membrane thickened above; spores 8, ovoid and blunt-ellipsoid, brown, bilocular, 14 to  $17\ \mu$  long, 7 to  $10\ \mu$  thick, a round spot in each loculus, with iodine a handsome blue, no change with KHO.

On micaceous rock in the San Gabriel Mountains and on trap in Topanga Canyon of the Santa Monica Range.

In the higher mountains of our district a *Rinodina* occurs having the thallus of the color of this species or darker, but in general form and size conforming with *Rinodina radiata*, the disk at first punctate, immersed, later similar to that of *R. radiata*, but unlike both *thysanota* and *radiata*, neither disk nor thallus ever found pruinose.

##### 5. *Rinodina turfacea* (Wahl.) T. Fries.

Crustaceous, verruculose or indeterminate, pale brownish ash color, KHO—,  $\text{Ca}(\text{ClO})_2$ —, the hypothallus indistinct; apothecia crowded in groups, adnate-sessile, 0.25 to 1 mm. wide; disk planoconvex, black; thalline margin persistent, thin, entire or crenulate; epithecium subcontinuous, yellowish brown; thecium colorless, 100 to  $124\ \mu$  high; paraphyses loose, the tips clavate and brownish; hypothecium pale yellowish tinted; asci inflated-clavate; spores 8, oblong-ellipsoid, bilocular, not at all or barely constricted, 16 to  $36\ \mu$  long, 8 to  $16\ \mu$  thick, with an obcordate spot in each loculus, the mature spores reddish brown, the spots of a light gray shade.

On earth and decaying roots; Santa Catalina Island on the latter substratum; on earth at Point Loma; on earth in crevices of rocks, Santa Monica Mountains in Topanga Canyon and Cahuenga Pass.

Our plant is the forma *nuda* T. Fries. The disk is naked, distinguishing it from the forma *roscida* (Sommerf.) T. Fries, which has a pruinose disk and has not as yet been found with us. The forma *minaraea* Nyl. (*R. minaraea* (Ach.) T. Fries) is much the same, the thallus uniform, the apothecia sessile, the disk strongly convex, reddish black and black, excluding the thalline margin. It is found on earth in the Santa Monica Range.

##### 6. *Rinodina conradi* Koerb.

Thallus uniform, rugulose-verrucose, sordid yellowish gray, KHO—,  $\text{Ca}(\text{ClO})_2$ —; apothecia at times quite numerous, sessile, 0.5 to 0.8 mm. wide; disk flat to planoconvex, brown blackish; thalline margin turgid, persistent, entire to crenulate; epithecium grayish yellow with a tinge of brown; thecium 116 to  $120\ \mu$  high, colorless, now and then a dash of pale straw color descending from the epithecium; paraphyses coherent, clavate at the colored tips, and after action of KHO seen jointed; hypothecium pale straw color, paler than the epithecium; asci inflated-clavate and ventricose; spores 8, reddish brown, 24 to  $31\ \mu$  long,  $12\ \mu$  thick, bilocular but by a secondary septation appearing 4-locular, epispore thin; hymenial structures stained blue with iodine.

On earth in the Santa Monica Range.

The thallus is similar in color to that of *R. angelica* Stizenb., but the latter is coarser, lobate at the periphery, and with the spores not so acuminate as those of *R. conradi*.

##### 7. *Rinodina confragosa* (Ach.) Koerb.

Crust whitish to ash-colored, thick, verrucose, the verrucæ becoming squamules and crenulate, KHO+yellow,  $\text{Ca}(\text{ClO})_2$ —; apothecia sessile, reaching 1.25 mm. in width; disk flat, dark brownish black with a turgid, crenulate thalline margin; epi-



thecium subcontinuous, dark yellowish brown; thecium colorless, 76 to 80  $\mu$  high; paraphyses loosely coherent, the tips clavate and colored; asci inflated-clavate, 70 to 72  $\mu$  long, 20  $\mu$  thick, the membrane thickened at top; hypothecium pale yellowish; spores 8, brown, blunt-ellipsoid and oblong-ellipsoid, 18 to 24  $\mu$  long, 11 to 13  $\mu$  thick, barely or not at all constricted, some slightly curved, bilocular, brown, the lumina roundish, gray; hymenial gelatine blue with iodine.

On rocks in the Santa Monica Mountains. Widely distributed throughout North America.

**8. *Rinodina sophodes* (Ach.) T. Fries.**

Thallus dark grayish brown, granulate-areolate, interruptedly limited by a black hypothalline border, KHO—, Ca(ClO)<sub>2</sub>—; apothecia numerous, small, 0.35 to 0.5 mm. wide; disk plane and planoconvex, dull black with a thin crenulate lecanorine margin, later becoming almost obsolete; epithecium subcontinuous, sordid yellowish brown, pale to dark; thecium colorless, 100 to 108  $\mu$  high; paraphyses coherent, some with small brown heads; hypothecium sordid pale yellowish; asci inflated-clavate; spores 8, oblong-ellipsoid, brown, bilocular, 16 to 20  $\mu$  long, 8 to 10  $\mu$  thick, the epispore thick, the lumina oblong, gray, the spores mostly a little curved; all hymenial structures stained a handsome blue with iodine, no change with KHO.

On various barks, common throughout North America: it is found in Europe, North Africa, Asia, and Oceania.

**9. *Rinodina exigua* (Ach.) T. Fries.**

Thallus thin, whitish or ash-colored, effuse, granular, or disappearing; apothecia smaller than those of *R. sophodes*; epithecium brown, subgranulose; thecium 70 to 80  $\mu$  high, with iodine blue; paraphyses loosely coherent, the tips brownish-capitate; hypothecium pale yellowish; asci inflated-clavate; spores oblong-ellipsoid, brown, bilocular, 15 to 20  $\mu$  long, 8 to 9  $\mu$  thick; disk black, convex, the lecanorine margin white, entire.

With and as common as *R. sophodes*.

**10. *Rinodina succedens* Nyl.**

*Lecidea succedens* Nyl. Flora **49**: 372. 1866.

*Rinodina succedens* Nyl.; Macoun, Cat. Canad. Pl. 117. 1902.

Thallus dull greenish ash color, rugose-verrucose, indistinctly rimose, KHO—, Ca(ClO)<sub>2</sub>—; apothecia sessile, 0.5 to not over 1 mm. wide; disk dull black, concave to flat; thalline margin persistent, turgid, entire, seldom slightly crenulate; epithecium subcontinuous, sordid pale yellowish ash color; thecium colorless, 136 to 140  $\mu$  high; paraphyses loosely coherent, slightly thickened and colored like the epithecium at the tips; hypothecium pale straw color; asci clavate and inflated-clavate; spores 8, 20 to 32  $\mu$  long, 11 to 16  $\mu$  thick, ovoid-ellipsoid, dark brown, bilocular, constricted, a round spot of paler brown without isthmus in each locus, the immature spores 26  $\mu$  long, 11  $\mu$  thick and colorless; iodine staining all hymenial structures blue; no change with potassium hydrate.

On bark of *Pseudotsuga macrocarpa* in our mountains from about 1,000 meters upward. Reported from Newfoundland by the late Rev. A. Waghorne.

**11. *Rinodina hallii* Tuck.**

Thallus effuse, ash color with a faint tint of light brown, more apparent when moist, rimose-areolate, the areolae concave with crenulate border, KHO—, Ca(ClO)<sub>2</sub>—; apothecia sessile, the thin lecanorine margin soon obsolete; disk dull black, convex, at first slightly pruinose; epithecium continuous, pale yellowish brown; thecium 124 to 128  $\mu$  high, with iodine deep blue, the epithecium not stained; paraphyses coherent, strict, the tips of some clavate and yellowish; hypothecium yellowish brown; asci inflated-clavate; spores 8, oblong, ellipsoid, 19 to 28  $\mu$  long, 8 to 12  $\mu$



thick, bilocular, brown, the lighter grayish colored spots round, some with indication of an isthmus.

On oaks in the San Gabriel Range at and above 800 meters elevation.

This has been sent by A. S. Foster from Westport, Washington, with a marked dull black hypothalline border and a somewhat darker thallus than the southern California lichen, growing on *Alnus*; also from the Santa Cruz Peninsula by A. C. Herre, the latter conforming in thallus and hypothallus to the southern lichen.

**12. *Rinodina roboris* (Dufour) T. Fries.**

Crust subdeterminate, whitish ash color, granular and chinky, KHO+ yellow,  $\text{Ca}(\text{ClO})_2$ —; apothecia generally numerous, sessile, 0.25 to 1 mm. wide; disk soon convex, brown black, the proper margin lighter in color and the thalline margin at last disappearing; hypothallus indistinct; spores the full size of those of *Rinodina sophodes*.

On various barks, dead wood, and fences. Frequent in the lowlands and ascending the mountains.

**PHYSICIACEAE.**

Thallus foliaceous, appressed, passing to the fruticulose state and then ascending, mostly attached by means of rhizinae, corticate and in general outline orbicular, the gonidia *Pleurococcus*; apothecia sessile, lecideine or lecanorine; paraphyses simple; asci with 8 spores, these brown, bilocular, rarely in exotic forms 4-locular to submuriform; sterigma jointed; spermatia straight, short.

**KEY TO GENERA.**

Cortex of upper surface evolved from upright hyphae.

Apothecia lecideine; disk with KHO+purple..... **PYXINE** (p. 127).

Apothecia lecanorine; disk with KHO—..... **PHYSICIA** (p. 128).

Cortex of upper surface formed of longitudinal hyphae; apo-

thecia lecanorine..... **ANAPTYCHIA** (p. 131).

**PYXINE** Fries.

Apothecium becoming lecideine; thallus similar to that of *Physcia*, appressed, both the dorsal and ventral surfaces corticular, the hyphae of the former vertical to the thalline surface, the lower cortex less developed and having longitudinal hyphae; epithecium staining violet with KHO; spores as in *Physcia*.

**1. *Pyxine soorediata* (Ach.) Fries.**

Thallus appressed, orbicular, creamy white, radiately rugulose toward the circumference, deeply lobed, the lobes contiguous, flattening, the border coarsely crenate, the lobes beset, particularly at the center, with soredia, KHO+yellow,  $\text{Ca}(\text{ClO})_2$ —, beneath white with grayish rhizinae; apothecia few and rarely present, adnate-sessile, lecideine, not over 0.5 mm. wide; disk flat, brown black; proper margin concolorous, persistent, entire; epithecium subgranulose, gray; thecium colorless, 72 to 76  $\mu$  high, with iodine blue (epithecium and hypothecium not stained); paraphyses free, with globular blackish heads, now and then forked above, the septation indistinct; hypothecium brown; asci clavate; spores 8, narrowly ellipsoid, pale brown to reddish brown, bilocular, 12 to 20  $\mu$  long, 4 to 7  $\mu$  thick, constricted, the epispore thin, the loculi often unsymmetrical in size, one being larger than its mate.

On dead and living *Sambucus glauca*, also on *Juglans californica*; rarely on rocks. Not uncommon in valleys and foothills, but very seldom with apothecia. Recorded as found throughout the United States east of the Rocky Mountains; also from Europe, southern and oriental Asia (Japan), Africa, and Oceania; southern Mexico, *Orcutt*.



**PHYSCIA** (Schreb.) Ach.

Thallus foliaceous, repeatedly lobed, lobes mostly narrow; apothecia circular, sessile, at times slightly elevated or subpedicellate, lecanorine; spores 8, brown, oblong to ellipsoid, bilocular (with us), the epispore thickened; sterigma multiarticular; spermatia short, straight, seldom acicular and bowed.

## KEY TO SPECIES.

Thallus appressed.

Thallus white to light gray.

Sorediate at center..... 3. *P. astroidea*.

Not sorediate.

White beneath.

Thallus orbicular, laciniate-radiate..... 4. *P. crispa*.

Thallus orbicular-stellate..... 1. *P. stellaris*.

Dark beneath..... 2. *P. aipolia*.

Thallus green gray..... 5. *P. adglutinata*.

Thallus not appressed, ascending more or less.

Some shade of gray.

Broadening at periphery..... 8. *P. tribacia*.

Not broadening at periphery.

Hooded at the extremities..... 6. *P. hispida*.

Not hooded..... 7. *P. setosa*.

From gray becoming reddish and brown.

Not pruinose, in color brown..... 10. *P. obscura*.

Pruinose throughout.

Thallus sorediate.

Densely coralloid-sorediate..... 9d. *P. pulverulenta*  
*isidiigera*.

Sorediate only on the margin of the laciniae..... 9c. *P. pulverulenta*  
*pityrea*.

Thallus not sorediate.

Thalline margin(exciple)crowned with lobules. 9b. *P. pulverulenta*  
*subvenusta*.

Thalline margin not lobulate.

Laciniae of thallus relatively broad..... 9. *P. pulverulenta*.

Laciniae of thallus narrowly linear..... 9a. *P. pulverulenta*  
*angustata*.

**1. Physcia stellaris** (L.) Nyl.

Thallus orbiculate-stellate, appressed, whitish to silver gray, glaucescent, beneath pale with pale rhizinae, KHO+yellow; apothecia sessile and subsessile, numerous; disk commonly plane, black or pruinose; thalline margin persistent, generally entire (or crenate); epithecium subcontinuous, yellowish gray; thecium colorless, 116 to 120  $\mu$  high; paraphyses rather loosely coherent, the colored tips clavate, not jointed; hypothecium colorless, milky; asci inflated-clavate, the thickened part reaching the epithecium; spores ovoid-ellipsoid, steel gray to brown, bilocular, 16 to 25  $\mu$  long, 10 to 12  $\mu$  thick, the lumina round or flat-obcordate; epithecium and thecium blue with iodine, KHO—.

Frequent throughout, on stones, bark, and dead wood, from the plains ascending the mountains to an elevation of 2,000 meters. Cosmopolitan.

**2. Physcia aipolia** (Ach.) Nyl.

Thallus stellate, loosely appressed, whitish to gray, glaucescent, epruinose, laciniate, the laciniae many-cleft, contiguous and imbricate, narrow, spreading toward the periphery and there also dilated, beneath brownish gray and darkening with gray or dark rhizinae, the surface and medulla yellow with KHO, Ca(ClO)<sub>2</sub>—; apothecia



rare with us, small, sessile; disk planoconvex, black, naked, the thalline margin entire, persistent; epithecium subcontinuous, yellowish gray; thecium 60 to 84  $\mu$  high, colorless, iodine staining it blue, as also, but not so readily, the epithecium and hypothecium; paraphyses loosely coherent, the septation not distinct; hypothecium colorless; asci inflated-clavate; spores 8, ellipsoid, brown, bilocular, 17 to 22  $\mu$  long, 8 to 11  $\mu$  thick, the lumina flat-obcordate with an isthmus.

On rocks and bark, through North and South America and Europe.

This and *Physcia stellaris* vary in width and division of laciniae and are similar plants, but distinguishable by the different chemical reaction. The thalline margin is well supplied with gonidia that also continue under the hypothecium.

### 3. *Physcia astroidea* (Fries) Nyl.

Thallus stellate-orbicular, appressed, microphylline at the periphery, the central part merged into a continuous mass of soredia; thalline medulla yellow with KHO, the yellow reaction with calcium chloride (Crombie) failing with us, dark beneath, rhizinae few and short; apothecia rather few, often absent; disk concave, black, pruinose; thalline margin erect, persistent, entire or lightly crenulate; epithecium subcontinuous, pale yellowish gray; thecium colorless, 84 to 96  $\mu$  high; paraphyses loosely coherent, the tips thickened and colored; hypothecium about the color of the epithecium, but slightly paler; asci clavate; spores 8, oblong-ellipsoid, 12 to 21  $\mu$  long, 7 to 10  $\mu$  thick, brown, bilocular, the epispore thin, the lumina round.

On bark, preferably that of *Juglans californica*, in the Santa Monica Range and at Highland Park near South Pasadena. It is reported throughout the United States and from southern Europe into Africa.

### 4. *Physcia crispa* (Pers.) Nyl.

Thallus orbicular, appressed, whitish, laciniolate-radiate, the laciniae broadly linear, convex, toward the periphery palmately cleft, spreading and dilating, the final divisions flattened and imbricate, beneath pale with few, short, white rhizinae, KHO staining the surface yellow,  $\text{Ca}(\text{ClO})_2$ —; apothecia sessile, from 0.25 to 1 mm. wide; disk flat, black, the thalline margin persistent, entire or finely crenulate; epithecium subgranulose, brown; thecium colorless, 40  $\mu$  high, blue with iodine including the epithecium and hypothecium; paraphyses coherent, with globular brown heads, furcation or septation not seen; hypothecium almost colorless (a faint yellow tinge); asci inflated-clavate; spores 8, ellipsoid, brown, bilocular, 13 to 24  $\mu$  long, 6 to 10  $\mu$  thick, generally not constricted; sterigma articulate, constricted; spermatia 4 to 6  $\mu$  long, a little over 1  $\mu$  thick, straight.

On bark of *Juniperus*, on the desert slope of the San Bernardino Range. Occurs in eastern United States; recorded from Polynesia.

### 5. *Physcia adglutinata* (Floerke) Nyl.

Thallus orbicular, small, sordid greenish gray or pale olive green, closely appressed, the laciniae discrete or contiguous, sparingly divided, mostly merging into a sorediate state; very rare in fruit with us, the spores 14 to 22  $\mu$  long, 8 to 11  $\mu$  thick.

On various barks; frequent on *Juglans californica* in the Santa Monica Range. Becoming conspicuously fresh green after rains. Throughout the United States; also in Europe.

### 6. *Physcia hispida* (Schreb.) Tuck.

Thallus small, white to silvery gray, the narrow, stellately arranged laciniae separate, loosely adherent to suberect, the ends of the more or less palmately cleft laciniae "vaulted and inflated," particularly the central ones, the peripheral inclining more to a spatulate, crenulate termination, the border of the laciniae loosely beset with spreading dark fibrils, beneath pure white, mealy; apothecia sessile, small, not exceeding 1.25 mm. in width; disk flat, black, naked or densely pruinose; thalline margin entire, erect; epithecium subcontinuous, brown; thecium colorless; para-



physes coherent, their tips clavate and colored, septate, a few furcate below the heads; hypothecium colorless; asci inflated-clavate; spores 8, bluntly ovoid-ellipsoid, 16 to 22  $\mu$  long, 7.5 to 9  $\mu$  thick, brown, bilocular, toward maturity slightly constricted; hymenial gelatine with iodine blue.

On barks chiefly, but also on rocks; rarely found in fruit. Throughout the United States; also in Europe and in Algeria.

**7. *Physcia setosa* (Ach.) Nyl.**

Thallus loosely appressed, gray and grayish brown, laciniate, the laciniae sinuate and lobed and cushioned upon a bed of short black fibrils, no reaction with potassium hydrate or calcium chloride; apothecia few, sessile, small, not over 1.25 mm. wide; disk concave, brown black; thalline margin incurved, turgid, entire, the amphithecium also with the characteristic fibrils; "spores 20 to 25  $\mu$  long, 10 to 14  $\mu$  thick." (Tuckerman.)

On earth (apparently); collected by T. S. Brandege in Lower California.

**8. *Physcia tribacia* (Ach.) Nyl.**

Lobes short, dilated, imbricate, suberect, lacerate-crenate and leprose-sorediate at the border, KHO+yellow, Ca(ClO)<sub>2</sub>—, beneath white with fine fibrillae; only sterile plants found.

Upon earth and rocks in the Santa Monica and San Gabriel Ranges.

**9. *Physcia pulverulenta* (Schreb.) Nyl.**

Thallus orbicular, loosely appressed, pale greenish to reddish brown, manifold-laciniate, the laciniae separate from the center, much cleft and spreading toward the periphery, hence contiguous and imbricate, the termination lobulate-crenate, pruinose especially toward the paling extremities of the laciniae, KHO—, beneath dark, paling outward, dark-fibrillose; apothecia sessile and subpedicellate, often crowded centrally, 0.5 to 2.5 mm. wide; disk concave to flat, densely pruinose; thalline margin persistent, erect (containing but few gonidia, none beneath the hypothecium), at times with several ray-like lobules; epithecium dark reddish brown, gradually fading downward, imposed upon it a thin hyaline layer (pruina?); thecium 140 to 144  $\mu$  high, faintly brownish, the lower part nearly colorless; paraphyses coherent, indistinctly septate, slightly clavate above, some furcate below the tips; hypothecium faint brown; asci clavate, reaching the lower border of the colored epithecium, the membrane thickened above; spores 8, ovoid, broadly ellipsoid, 24 to 32  $\mu$  long, 12 to 16  $\mu$  thick, bilocular, dark brown, constricted, the lumina large, round; all the hymenial structures stained blue with iodine, except the hyaline layer above the epithecium.

On barks and rock, throughout from the foothills and extending to higher elevations, where (above 1,000 meters) it attains its best development. Of its varying forms the following are found in our territory: Forma *leucoleiptes* Tuck., white with the "lobes flat, interruptedly elevated and powdery at the margins, beneath black"—on *Sambucus glauca* in the Santa Monica Range; forma *muscigena* (Ach.) Nyl., having the laciniae short and broad, imbricate, gray to mostly chestnut brown, very seldom found in fruit—on earth and rocks; and forma *argyphaea* Nyl., with the laciniae broader and shorter than in the species of the other forms, the distinguishing character, however, being the dense, white pruina covering disk and thallus—more common than the preceding forms but often sterile; on the ground and on rocks in the San Gabriel Range; on bark of *Fraxinus dipetala*, Topanga Canyon, Santa Monica Range.

**9a. *Physcia pulverulenta angustata* Nyl.**

Thallus in color like the species, but somewhat paler, the laciniae narrow, resting on dense cushions of dark fibrils.

On smooth oak bark along the "New Trail" to Wilson's Peak on the western slope of the San Gabriel Range at about 800 meters.



**9b. *Physcia pulverulenta subvenusta* Nyl.**

Thalline margin crowned with lobules, this about the only difference from the species. On bark, occasionally with the species.

Along the "Mormon Trail" below Skyland, San Bernardino Mountains, *Reed*; near "Lone Pine Mine" in the Tehachapi Mountains.

**9c. *Physcia pulverulenta pityrea* (Ach.) Nyl.**

Thallus smaller than the species, grayish to subcervine, the border of the laciniae sorediate-lined; sterile with us.

On wood and mossy rocks in the Santa Monica and San Gabriel ranges.

**9d. *Physcia pulverulenta isidiigera* Zahlbr.; Herre, Proc. Washington Acad. Sci. 7: 362. 1906.**

Thallus orbicular, thickened, appressed, of a somber brownish color, pruinose, the extremities of the laciniae visible, the body disguised by a dense growth of coralloid isidia; apothecia closely sessile; disk black, papillate, mostly epruinose; thalline margin thickened with the dense isidia; spores ovoid-ellipsoid, 26 to 36  $\mu$  long, 10 to 14  $\mu$  thick.

The type was collected by A. C. Herre at Mayfield. On moss-covered, shaded rocks in the north fork of Matilija Canyon, Ventura County; San Jacinto Mountains at 1,500 meters altitude, on bark of dead oak; Santa Ynez Canyon, Santa Monica Range.

**10. *Physcia obscura* (Ehrh.) Nyl.**

Thallus orbicular, dark gray to dark brown, the laciniae narrow, convex, palmately divided outward, appressed, beneath black and thickly black-fibrillose; apothecia (rare with us) from 0.5 to 2 mm. wide, adnate-sessile; disk flat, black, epruinose; thalline margin entire, persistent; epithecium dark brown, granulose; thecium colorless, 124  $\mu$  high, blue with iodine, then sordid greenish blue; paraphyses capitate and lightly colored above, septate; hypothecium faint brownish; asci elongated-clavate; spores 8, dark brown, oblong-ellipsoid, 16 to 30  $\mu$  long, 9 to 16  $\mu$  thick, bilocular, the lumina top-shaped, attenuate toward the septum.

On bark and mossy rocks; on bark in the Santa Monica Mountains; on decaying moss on rocks in Yosemite Valley. Throughout the United States, extending to the Arctic region; in Europe, northern Africa, and New Zealand.

**ANAPTYCHIA Koerb.**

Thallus from foliaceous to subfruticulose, repeatedly laciniate, diffusely prostrate or ascending, the laciniae generally narrow, flat or subcanaliculate, the upper cortex tough, resistant; apothecia round; disk dark, naked or pruinose; spores brown, bilocular.

**KEY TO SPECIES.**

With KHO the cortex yellow, the medulla unchanged..... 1. *A. erinacea*.

With KHO both cortex and medulla yellow..... 2. *A. leucomela*.

**1. *Anaptychia erinacea* (Ach.) Herre, Proc. Washington Acad. Sci. 12: 261. 1910.**  
*Borrera erinacea* Ach. Lich. Univ. 499. 1810.

Thallus erect and suberect, loosely branching, gray above, whitish beneath, the laciniae narrow below, dilating upward and becoming lobate, the border white, pulverulent and ecorticate, KHO+yellow, the medulla not staining, no reaction with calcium chloride; cortex arising from lengthwise running hyphæ; medulla thin, of narrow, wavy hyphæ, the gonidial layer on the whole nearer the lower surface, but changeable to middle or upper part; apothecia subpedicellate; disk black to pruinose, soon convex, the thin, entire margin then excluded; epithecium continuous, light reddish brown gradually paling downward; thecium 100 to 104  $\mu$  high, pale reddish brown above, almost colorless below; paraphyses coherent, with clavate, colored tips;



hypothecium about the color of the upper thecium, a thin gonidial layer underlying the hypothecium; asci clavate; all hymenial structures stained blue with iodine, no change with KHO; spores 8, oblong-ellipsoid, brown, 16 to 32  $\mu$  long, 7.5 to 15  $\mu$  thick; spermatia staff-shaped, 6 to 8  $\mu$  long.

On shrubs along the California coast and on the adjacent islands.

2. *Anaptychia leucomela* (L.) Herre, Proc. Washington Acad. Sci. 12: 261. 1910.

*Lichen leucomelos* L. Sp. Pl. ed. 2. 1613. 1763.

Loosely suberect, pale greenish ash color, glaucescent above, beneath white, channeled, the laciniae linear, sparingly divided, latterly furcate at the extremities, the border with strong, blackening, forked fibrils, with KHO the cortex and medulla yellow,  $\text{Ca}(\text{ClO})_2$ —; apothecia pedicellate; disk dark, pruinose, the thalline margin lobulate; epithecium continuous, dark greenish brown; thecium colorless, 92 to 96  $\mu$  high; paraphyses coherent, the tips thickened and colored, some furcate above; hypothecium pale straw color; asci inflated-clavate, all hymenial structures staining blue with iodine; spores 8, oblong-ellipsoid, 22 to 24  $\mu$  long, 10 to 13  $\mu$  thick, bilocular, brown, the lumina rounded, becoming flat, with an isthmus; a thin gonidial layer underlying the hypothecium.

The fruiting specimen from which the description is taken was collected near Cape San Quentin, Lower California, by Dr. E. L. Greene. Specimens from Santa Catalina and Santa Rosa islands, *Trask*, are sterile.